Chapter 4

Geology and Hydrogeology

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General Remarks

Comment O-1.515

4.1 p. 4-I. Jones & Stokes has failed to provide a clear analysis of Taiheijo Cement Corp's proposed action regarding water resources. This entire section is vague and fails to adequately describe the site, particularly groundwater resources.

Ortman, David

Response

Water resources are one of the major issues addressed by the EIS. King County recognizes the critical importance of water on Vashon/Maury Island, and has identified both Vashon and Maury island as a Critical Aquifer Recharge Area and as Ground Water Protection special district overlays. Because of the importance of groundwater, King County required the applicant to provide additional information, per WAC 197-11-100, by drilling five additional monitoring wells.

The analysis presented in the EIS is intended to be concise, clear, and to the point, per WAC 197-11-400(3). The main point expressed in Chapter 4 is that mining could take place on the site without significantly affecting groundwater. Two facts provide the major evidence to support this conclusion: (1) mining would not significantly reduce aquifer recharge (and would, in fact, increase recharge rates during active mining); and (2) groundwater at the site moves toward Puget Sound and away from wells used for drinking water. These facts were further supported by the study conducted on behalf of Ecology (Pacific Groundwater Group 2000).

Comment

Further examination of these and other factors by professionally motivated and competent hydrologists and engineers is essential to full understanding of the potential damage which could be caused by the proposed mining. Detailed analytical modeling of the entire aquifer is required, by persons who are unbiased and not previously used by Lone Star in other endeavors.

Fitch, Bob & Madeline

Response

King County has determined that the EIS Team is qualified to evaluate environmental impacts of the proposed project. The consultants on the EIS Team work for King County.

A numerical simulation model has been developed by Ecology. The simulation provides additional details on changes that the proposed mining activity would have on the groundwater recharge regime at the site, and confirms that the proposed mining would cause no significant impacts to the groundwater system.

4.1 Primary Issues

No substantive comments were received that specifically address this section.

4.2 Affected Environment

4.2.1 Information Sources

EIS Team

Comment O-1.159

p. 4-2. This section states that King County's EIS consultant team provided input on where five monitoring wells should be located. Please identify the King County EIS consultant team and their fields of expertise.

Ortman, David

Comment C-8.030

What is King County's independent analysis on site groundwater and geologic data? Who is the EIS consultant team, and what are their credentials? Who prepared the reports and conclusions? The DEIS indicates the consulting team used descriptions taken from samples of drilled materials to assess site geology. Who is this team? How were samples taken?

Vashon-Maury Island Community Council

Comment I-7.024

What consultants make up King County's "EIS consultant team?" What is the contractual relationship between the various consultants and King County? Weren't some members of this team actually contracted directly to the applicant, and isn't this a conflict of interest?

Meyer, Michael

Response

King County's independent analysis of the groundwater and geologic data is contained in Appendix A of the DEIS and in the text of the DEIS/FEIS. The King County EIS Team consists of King County DDES, Jones & Stokes (the primary consultant in the SEPA process), Terra Associates, and King County DNR. Jones & Stokes is the primary contractor to King County. Terra Associates is working as a subcontractor to Jones & Stokes. Terra Associates provided technical lead for Geology and Hydrology (Chapter 6) and Environmental Health (Chapter 10) disciplines.

At Terra Associates, the primary personnel were Charles R. Lie and Ted Schepper. Mr. Lie is a geologist with more than 25 years of experience working with the stratigraphy of Puget Sound. His work has included hydrogeologic evaluations on both a regional level and a site-specific level. Mr. Lie has performed hydrogeologic work for the current Health Hazards Project on Vashon Island. Mr. Ted Schepper is a Professional Engineer licensed to practice in Washington State specializing in earth materials and groundwater. Mr. Schepper has more than 20 years of experience in the analysis of soils and groundwater. Both Mr. Schepper and Mr. Lie have worked on numerous large developments in King County analyzing the impacts of development, and mitigating site-specific issues relating to soils, geology, and groundwater.

At King County, the primary staff member involved in this effort is Ken Johnson, Ph.D., P.E. Dr. Johnson is the Groundwater Program Lead for the King County Department of Natural Resources, Water and Land Resources Division, Regional Water Resources Services Unit.

Groundwater measurements were taken by the Applicant's consultant, AESI. The County team made periodic visits to the site and observed that AESI field work was being conducted as planned. The methods employed are standard. King County used the data but made conclusions independent from the Applicant's consultants.

Comment O-1.160

It also states that King County's consultant team provided input on where wells should be located, reviewed and concurred with the locations, and observed drilling operations. With whom did King County's consultant team concur? Who actually carried out the drilling operations? Has Terra Associates ever had any consulting contracts with Taiheijo Cement Corp. or any of its subsidiaries?

Ortman, David

Comment O-1.468

Why did Terra Associates allow AESI (the applicant's consultant) to provide the locations of the test pits and monitoring wells?
Ortman, David

Response

The King County team presented proposed monitoring well locations to AESI, the applicant's consultant. Both the County team and AESI concurred on the proposed additional monitoring well locations.

Field operations were done under the direction of AESI. Terra has not worked for Lone Star and/or Glacier Northwest.

Comment O-1.162

This section also states that King County conducted an independent analysis. But according to Appendix A, Table 5, all the sampling was done by AESI, a consultant hired by Taiheijo Cement Corp. It states that King County's consultant team observed drilling operations but is silent on whether they observed sampling operations. Is it correct that all monitoring well sampling was done by AESI and that the King County consultant team carried out no independent sampling on site?
Ortman, David

Response

The County team observed the excavation of 14 new exploration pits, EP-16 through EP-29, and made periodic site visits during the drilling of the new observation wells OBW-5 through OBW-9. The County team representative observed that the sampling procedures followed locally accepted practices.

Applicant-supplied data is allowed under SEPA (WAC-11-100) and King County Environmental Procedures (KC 20.44). King County does retain sole responsibility for the preparation and content of EISs and other environmental documents tied to King County decisions. This requirement does not preclude the use of applicant-supplied data, including data supplied by the applicant (1) in a SEPA Environmental Checklist (or accompanying study), (2) per the request of King County under WAC 197-11-100 (Information required of applicants), or (3) voluntarily. King County exercised its discretion to consider such data as appropriate to evaluate impacts of this proposal, but retained sole responsibility for conclusions and content of the EIS.

Comment O-1.163

It states that these wells will continue to track groundwater levels. Who is tracking these wells? Who is gathering this data?
Ortman, David

Response

The Applicant's consultant is tracking the groundwater data. King County will provide oversight review as needed. In addition, groundwater levels were independently measured by the Ecology team.

Data Sources

Comment L-5.003

4. The USGS (Booth 1991) mapped recessional outwash on the north portion of the site. Relatively fine sand deposits were encountered near the surface in test pits. The DEIS acknowledges differences with the USGS interpretation of surface geology but appears to discount the Booth report as "a regional effort" (p. 4-3). In actuality, the Booth report is a very detailed account of surface geology on Maury Island. Discrepancies with this previous mapping effort should be specifically discussed in the DEIS.
Landau Associates

Response

The USGS maps are not discounted, but rather the EIS uses more precise site-specific information. The purpose and detail of a regional mapping effort differ from those of a site-specific mapping effort. For example, the USGS maps were based only on examination at the surface, and as stated by Booth (1991) in the accompanying report, "In the course of mapping, I inspected road cuts, foundation excavations, most stream channels, and the entire coastline of both islands." No specific subsurface exploration was done in the preparation of the Booth map. In contrast, extensive onsite subsurface exploration has been conducted as part of this analysis to verify site conditions. The variations from the Booth map are well documented by site-specific observations, as discussed in the DEIS.

Comment I-7.025

Where is the tabulated data? Where are the boring logs?
Meyer, Michael

Response

Tabulated data are presented in Appendix A and the AESI reports are available at the Vashon Public Library. The data are also summarized in the text of the FEIS.

Comment L-5-005

11. the advance outwash sand deposits described by Booth (1991) near the Dockton spring are discounted in the DEIS due to "a review of additional well logs" (Appendix A, pg. 5). Well logs recorded by a driller (which are the type of log being referred to in the DEIS) represent a happenstance data set that are typically of poor data quality. It is not responsible for the DEIS Team to discount specific geologic logging by an accomplished USGS geologist based on driller's well logs. The DEIS even admits, "the terms used by the drilling industry have not corresponded well with terms used by geologists and engineers" (Appendix A, pg. 10). If a credible discrepancy is noted that bears on an important matter of geologic interpretation, the DEIS Team should perform its own field investigation and present specific data that support their assertion. Carr (1983) provides an interpretation of surface geology near the Dockton spring that is similar to that of Booth (1991).

Landau Associates

Response

The commenter seems to overlook that well drillers' logs were used widely in the Carr study. It would be irresponsible to ignore the well logs in performing an analysis such as this. The source of the material needs to be documented and the assumptions defined. However, to discard relevant information would be counterproductive.

Comment O-1.161

The discussion in Sec. 4.2.1 does not correspond with the Appendixes. For example, Appendix A does not clearly identify the five monitoring wells. Please clearly identify these five monitoring wells in Sec. 4.2.1.

Ortman, David

Response

The FEIS (Section 4.2.1) has been revised to clarify locations of previously existing and new monitoring wells. The locations of onsite subsurface exploration points are shown on Figure 4-1 through 4-4 of the FEIS. The five monitoring wells constructed in 1999 to obtain additional information on site stratigraphy and groundwater levels are OBW-5, OBW-6, OBW-7, OBW-8, and OBW-9.

OBW-1 and OBW-2 were constructed prior to the DEIS process. No wells with the designation OBW-3 and OBW-4 were constructed. Exploratory borings EB-3 and EB-4 were drilled to obtain stratigraphic information. No wells were constructed in EB-3 and EB-4.

Comment O-1.069 4.2.4.3, p.4-8. This section refers to OBW-6 and OBW-7. However Figure 4-1 only shows OBW-1; OBW-2; OBW-5; OBW-6; OBW-7; OBW-8; and OBW-9.
Ortman, David

Comment O-1.170 What happened to OBW-3 and OBW-4?
Ortman, David

Comment O-1.172 On page 4-2, five monitoring wells are referred to. Are these the same monitoring wells identified as OBW-X on Figure 4-1? Why are seven observation wells shown on Figure 4-1? If these are not the monitoring wells referred to on page 4-2, where are these monitoring wells located?
Ortman, David

Comment O-1.426 [Appendix A] 3.4.2 p. 7. This section states that Terra Associates was present during the excavation of Exploration Pits EP-16 through EP-28. This represents only a small sampling of the exploration pits shown on Figure 5. It further states that shallow monitoring wells (P-1 and P-2) were installed in the northwestern portion of the site. What was the depth of these monitoring wells? Who installed these wells? Was Terra Associates present when these wells were installed?
Ortman, David

Comment O-1.427 3.4.4 p.8. This section states that Figure 3 illustrates the locations of the exploration borings. Who conducted the exploration borings and when were they made? Was Terra Associates present when these exploration borings were made? Only two exploration borings (EB-3 and EB-4) are identified on this Figure. Is this correct? Were only two exploration borings made?
Ortman, David

Comment O-1.428 It states that a summary of the on-site water levels is shown in Table 1. When was this data collected? Table 1 lists OBW-1, OBW-2, OBW-5, OBW-6, OBW-7, OBW-8, and OBW-9 and states that "All reference and static water elevations are provided by AESI" (the applicant's consultant). What happened to OBW-3 and OBWA? What independent analysis was performed by Terra Associates to confirm this data?
Ortman, David

Comment O-1.443 Figure 3. Why are only exploration borings EB-3 and EB-4 located on this Figure? What happened to OBW-2 and OBW-3?
Ortman, David

Comment O-1.444

Figure 3. Of the Observation Wells, Exploration Boring, Exploration Pits, and Piezometers, how many of these were carried out by AESI, the applicant's consultant?

Ortman, David

Response

The FEIS has been revised to clarify locations of monitoring wells. The five monitoring wells referred to in the DEIS are the five new monitoring wells, OBW-5 through OWB-9. OBW-1 and OBW-2 were constructed prior to the DEIS as part of an initial site evaluation. No wells with the designation OBW-3 or OBW-4 were constructed on the site. These borings were numbered consecutively by AESI with the original two observation wells. These two exploration borings, EB-3 and EB-4, were not completed as monitoring wells at the time they were drilled. It is common practice in geologic studies to assign unique numbers to all borings, whether or not a well is installed.

Comment L-5.002

2. Many of the conclusions contained in the DEIS appear to be based on data including installation and monitoring of seven groundwater monitoring wells on the site (Figure 1). Two of these wells were drilled in compliance with Department of Ecology (Ecology) monitoring well regulations for resource protection wells. The other five wells do not conform to the minimum standards for resource protection wells (e.g., the wells are not properly sealed to isolate a specified aquifer zone). The lack of compliance with well regulations has the potential to affect the quality of data collected.

Landau Associates

Response

If Ecology determines that the wells were not appropriately drilled, then the Applicant would be required to work with the drilling contractor to correct any issues. If this involves drilling new wells, the new data would be used for final design of the project.

Comment C-9.006

Important omissions in the DEIS: all surface water quality data; all soil logs from drilled wells; core sampling from the nearshore; well data from some of the drilled wells; lab test data or arsenic leachability under site conditions; perched water data. The conclusion that surface water would not be a source of groundwater contamination is not confirmed by tests. Absence of soil logs hinders objective review. Core sampling data are required for making conclusions about potential and historical contamination of the marine environment. Data collected from

drilled wells could be important for determining quality and quantity of existing groundwater. A wider range in lab testing of soil-bound arsenic could be expected to show different results. The quantity and quality of perched water will determine its potential as a possible source of aquifer contamination.

Vashon-Maury Island Community Council

Comment O-1.463

Appendix B to Appendix A- Regarding the Well Logs. Please identify any Maury Island well logs that were not included in Appendix B.

Ortman, David

Comment

Our hydrogeologist has obtained information regarding AESI's information from DOE, and unless there is additional information from the references which was not provided to DOE, the community will have a copy available through our public library as of August 19, 1999, approximately half way through the comment period. Two hydrogeologists have advised me that the DEIS cannot be adequately analyzed without the data, e-mails and well logs which AESI provided, and therefore, I would like to note that the DEIS is incomplete as that information was not included for review. Both hydrogeologists mentioned that the well logs for the Lone Star site were not even included with the other well logs for the island.

Nelson, Sharon K.

Response

The soils data, including exploration boring and pit excavations from the onsite explorations, is presented by reference in Appendix A of the DEIS. Well logs were also included in Appendix A of the DEIS. The AESI reports referenced in Appendix A of the DEIS are available at the Vashon Public Library. Results of leachability tests are given in Appendix B of the DEIS. No widespread perched water has been identified on the site. The testing of soils for arsenic was done in accordance with Ecology protocols.

As noted in the Fact Sheet, additional background information was made available for review at the offices of King County DDES and Jones & Stokes.

4.2.2 Geology

4.2.2.1 Site Topography

Comment O-1.164

4.2.2.1 p. 4-3. This section states that past mining has removed up to 250 vertical feet of material. What is the estimated cubic yards of material that has been removed from this site since mining began?

Ortman, David

Response

The amount of material removed from the site is on the order of 7 to 10 million cubic yards. More specific estimates are neither essential nor relevant to understanding significant adverse impacts from future mining nor to making a reasoned choice among alternatives.

Comment

Section 4.2.2.1, Site Topography – Despite the fact that the DEIS claims that the marine-facing bluffs are "covered by native vegetation," People for Puget Sound's Citizen Shoreline Inventory volunteers have identified the presence of non-native, invasive vegetation (Scot's broom and Himalayan blackberry) in 27 out of 34 (or 79%) 150-foot sections of shoreline on this site. Section 5.4.2.2, Madrone Reforestation, states that "Scot's broom and other weedy species could be controlled during the first 5 to 10 years of stand replacement." This suggests a naive and cavalier attitude toward invasive species, and in no way adequately addresses the threat of invasive species to shoreline or upland habitat.

People for Puget Sound

Response

Impacts due to invasive, non-native plant species are addressed in Chapter 5 (Sections 5.3.2 and 5.3.3). Measures to mitigate spread of invasive non-native species are included in Terrestrial Mitigation 1 (Section 5.4.3.2).

4.2.2.2 Surface Materials

Comment L-5.004

9. The DEIS apparently uses agricultural soil classification system (Appendix A, pg. 5) to help determine the lateral extent of till (Appendix A. Figure 8).

Landau Associates

Response

Soil Conservation Service (SCS) mapping information was used to be consistent with traditional environmental assessments of sites. This information is presented for planners who are more familiar with SCS mapping units than with formal geologic soil units. The SCS maps were not used for any analysis by the County team.

Comment

It is not clear how soils were "formed onsite by erosion of underlying materials".

Kuperberg, J. Michael, Ph.D.

Response

This sentence has been corrected in the FEIS.

4.2.2.3 Subsurface Materials

Comment O-1.179

4.2.4.6 p. 4-9. Jones and Stokes uses three different terms to describe the layer below the Vashon outwash sediments: "the Olympia Formation" (p.4-5); "Quaternary Transition Beds" (p.4-8); and "pre-Vashon sediments" (p 4-9). Please explain the difference in these terms.

Ortman, David

Response

The Olympia Formation is described as being deposited "during or at the close of the Olympia Inter glaciation." The Quaternary Transitional Beds are described as being lacustrine deposits deposited in a proglacial lake that formed when the advancing Vashon glaciers blocked the northern end of Puget Sound (Booth 1991). Pre-Vashon sediments describe all sediments regardless of their texture that were deposited prior to the Vashon glaciation. The complexity of the glacial deposits and the absence of large exposures of the deposits due to dense vegetation preclude absolute certainty on the ages and correlations of geologic deposits throughout this part of Puget Sound.

Comment L-5.006

6. The Olympia interglacial deposits underlie Vashon age glacial deposits beneath much of Puget Sound. They represent fine-grained deposits of sand, silt, and clay. Because they have been overridden by glacial ice, they are typically dense to very dense. Olympia deposits are equivalent to "Unit III" described by Carr (1983). Booth describes these deposits as consisting of a variable silty fine sand. Deposits can overlie thick sequences of silt and clay on Maury Island. This unit is often correlated with aquitard

deposits. However, sand layers within this deposit are capable of low to moderate well yields. The DEIS describes the Olympia deposits as fine sand with traces of wood (pg. 4-6). The report concludes that the Olympia deposits are unusual in that "silts and clays are absent" (pg. 4-8). This is an important interpretation because the DEIS goes on to say that for the purpose of the DEIS analysis, the deep and principal aquifer systems are combined. In our opinion, site data do not justify a different interpretation of the aquifer system from that of Carr (1983) which described the Olympia deposits as representing an aquitard that separates aquifers present on Vashon and Maury Islands. Specific concerns with the DEIS interpretation include: geologic logs (recorded by a geologist) from onsite borings indicate that these deposits are typically a very fine to fine sand with interbeds of silt (AESI 1999) unlike the description in the DEIS. The presence of thin layers of silt within the Olympia deposits is significant because these deposits can act as a significant aquitard; Booth (1991) describes Olympia silt and clay deposits that underlie sandier silt and clay deposits beneath Maury Island. In consideration of Booth's detailed description of interglacial deposits on Maury Island, a logical interpretation of the geology beneath the site is that onsite borings did not penetrate deep enough to encounter the typical silt and clay associated with Olympia interglacial deposits; characterization of the Olympia interglacial deposits is important for characterizing the thickness and hydraulic continuity of aquifers at the site. The DEIS should provide additional characterization of these deposits to adequately describe their hydrogeologic properties.

Landau Associates

Response

The FEIS will not refer to the pre-Vashon sediments encountered beneath the site as being Olympia Beds. As discussed in the FEIS, the assumption that the aquitard is either not present or has significant vertical permeability beneath the site is a conservative assumption to be used in the analysis.

The Carr study was an Island-wide study and does not preclude considerable site-specific variability in geologic deposits. Further, the assumption that there is significant hydraulic continuity between the primary and the deep aquifer is a conservative assumption. Booth's description of the Olympia beds includes silty fine sands. However, to avoid confusion, the underlying soils encountered in the site exploration will be referred to as pre-Vashon sands in the FEIS.

Booth has given an age for the Olympia Beds as being older than 18,000 years before present (bp). Radiocarbon dating of organic

material sampled from the lower pre-Vashon deposits by AESI indicates that these deposits are older than 45,000 years bp. Hence, it is possible that the Olympia Beds, in their classic lithology at least, are not present beneath the site.

Comment L-5.004

6. Glacial till deposits are typically silt, sand and gravel deposits that are very dense. These soil deposits typically mantle the upland areas of Puget Sound, are commonly near the ground surface, and are stratigraphically located between recessional and advance outwash sand deposits. Till typically has low to very low permeability that can inhibit the downward movement of infiltrating rainwater. Consequently, characterization of the presence of till is an important factor in understanding recharge patterns at the site. The DEIS characterizes till at the site as occurring as thin pockets (pg. 4-5) that lack the "concrete-like structure found elsewhere" (pg. 4-4) (Appendix A. pg. 4). The extent of till at the site is based in large part on 34 test pits (AESI 1999) dug to depths ranging from 6 to 16.5 ft. The DEIS interpretation of the extent of till at the site is presented in Figure 4 of Appendix A. In our opinion, the DEIS characterization of the till is questionable for a number of reasons. In contrast to the DEIS, the USGS (Booth 1991) mapped till as being present over most of the uplands portion of the site. Characterization of recessional outwash deposits as advance outwash deposits would result in a misinterpretation that till was absent; the till is described as occurring at depths of less than 20 ft (pg. 44), however none of the test pits were dug to 20 ft, and the majority were dug less than 13 ft (i.e., most test pits may have been terminated prior to reaching the till depth).

Landau Associates

Response

The nature of till is not uniform. The texture, density, and permeability of till has a wide range of characteristics. Our observations on the till were made by directly entering the exploratory pits where safe and practical.

Comment L-5.004

8. Unexplored areas are assumed to lack the presence of till apparently without regard to data trends. This non-conservative approach to site characterization is not consistent with the potential impact of the project on the island's sole source aquifer system; the description of till as lacking a "consolidated concrete structure" is not consistent with observations of till outcrop by Landau Associates on a 12/28/98 site visit. A till outcrop near the central

portion of the site consists of a matrix supported sand and gravel with cobbles, similar in structure to concrete. Conclusions regarding the density of the till are difficult since density of the till does not appear to have been measured directly at any site exploration using standard geotechnical methods.

Landau Associates

Response

The explorations onsite were conducted according to locally accepted geotechnical and geologic practices. The information from the exploration pits is consistent with onsite till exposures and the results of the deeper explorations.

Based on site-specific observations and onsite explorations, the thickness of the till cap increases toward the bluff along Puget Sound. It is quite likely that the thicker interior till materials exhibit the common cemented nature. No further explorations are needed to map the extent of the till.

Comment L-5.004

7. Seepage and orange mottled soil, an indication of a near-surface water bearing zone (NSWBZ) was encountered in test pits (i.e., EP-7, EP-14, EP-17) where till was interpreted not to be present. Evidence of a NSWBZ at these locations suggests till at a depth greater than the test pit maximum depth; the map of till extent (Appendix A, Figure 4) appears to be biased to minimize the presence of till.

Landau Associates

Response

Exploration Pits EP-7 and EP-14 were dug in the bottom of the existing mine excavation. The seepage encountered in these test pits would be expected and represents the principal aquifer. No investigator has mapped till as being present at that elevation in the immediate vicinity of the site or on the site. Exploration Pit EP-17 was excavated along the northern margin of the site and is the only exploration pit where significant seepage was encountered on the entire upland portion of the site. To evaluate the conditions encountered in EP-17, EP-18 was excavated west of and lower in elevation than EP-17. In EP-18, the till cap consisted of a 3-foot thick layer of silty sand. Advance outwash was encountered at a depth of 4 feet. No seepage was encountered in this lower western test pit, EP-18. Hence the perched water encountered in EP-17 has been interpreted as a local pocket of water that is not laterally extensive and is not expected to drain to offsite sources.

Comment O-1.171

All the observation wells are located at the periphery of the site. None are located within the proposed project area. Therefore, how can Jones & Stokes assert that there are not additional layers of more dense material within the project site itself?

Ortman, David

Response

The purpose of the new observation wells was to provide monitoring points that will be present prior to, during, and following mining. Hence, the new monitoring wells were constructed within buffer areas where no mining would occur that would require abandonment of the monitoring wells. In addition, the central point of the site has significant soil exposures that correlate well with the perimeter explorations. Direct observations of exposed soils are generally more detailed than could be obtained from an exploratory boring.

Comment L-5.003

3. Recessional outwash. Where present, these soils can represent significant aquifer deposits and can contribute to the presence of near-surface perched water zones. The DEIS does not mention the presence of recessional sand deposits. However, there are indications that they are present at the site.

Landau Associates

Response

No recessional outwash deposits were specifically identified during subsurface exploration performed onsite.

Comment L-5.005

5. Advance outwash deposits are alluvial or river-generated soil deposited in front of an advancing glacier. These deposits typically range in size from fine sand to gravel. Interfingered silt deposits within the sand and gravel are common. These silt layers can present significant hydrogeologic layers capable of perching and channeling groundwater as it infiltrates through the unsaturated zone. The occurrence of springs, perched aquifers and concentrated recharge can result from these silt layers. The DEIS characterization of advance outwash suggests that there is no organized layering (pg. 4-5) and that silt layers that are present occur as localized deposits (Appendix A pg. 4) that are not laterally continuous (Appendix A, pg. 7). It is implied that these layers do not have hydrogeologic significance. In our opinion, the characterization of silt layers within the advance outwash is incomplete. It is likely that silt layers are present and that these layers channel and perch infiltrating groundwater.

Landau Associates

Response

Significant vertical exposures exist on the site that allow direct observation of the nature of the advance sand deposit on the subject site. No silt layers have been mapped in the existing exposures. As discussed earlier, no direct evidence of continuous silt layers has been found in site-specific explorations. Supplemental explorations would be performed at selected areas prior to mining to further define the subsurface conditions during the design of the individual mine cells.

Comment L-5.003

5. Fine to medium sand encountered at the surface in test pits were described as advance outwash. However, the advance outwash is described in the DEIS as grading from "coarser sand and gravel near the top to finer sands near sea level" (pg. 4-5). The description of near-surface fine to medium sand is more consistent with a recessional outwash then the advance outwash. Additional explorations should be conducted to resolve this discrepancy with the USGS mapping. Additional explorations should be at least 20 ft deep.

Landau Associates

Comment L-5.004

10. In our opinion this methodology is not appropriate for the following reasons: 1) the method is an indirect characterization of geologic conditions and is, therefore, associated with a high degree of uncertainty, 2) the soil mapping conflicts with direct geologic mapping of soil layers by the USGS, 3) till may be mapped as being not present where recessional outwash deposits overlie till or where the surface has been disturbed.

Landau Associates

Response

The description of till in the EIS is based on direct sampling. Conflicts with USGS mapping is expected, since we looked much more closely at the site, and directly sampled soils, whereas USGS conducted a general characterization of the whole island. Fine to medium and medium sands encountered near the top of the advance sand deposit were encountered beneath a till cap as shown in EP-4, EP-15, EP-16, EP-18, EP-19, EP-25, EP-27, EP-30, and EP-33. It is possible that there are local pockets of recessional sands above the till that is present on parts of the site. No widespread or continuous deposits of recessional outwash have been specifically identified in the onsite explorations. The Booth map does not show any extensive recessional outwash on the site. The Booth map shows that the recessional outwash that was mapped was along the extreme northern margin of the site. This would position the mapped recessional sands within the buffer area outside of the proposed mine.

Comment L-5-005

(part 6). Also, the DEIS states that advance outwash described by Booth (1991) near Dockton spring is probably not advance outwash but older interglacial deposits (Appendix A, pg. 5). This assertion is unsupported within the DEIS and has potentially strong implications for interpretation of the impact of the project on the spring.

Landau Associates

Response

The hydraulic continuity between the principal aquifer beneath the site and the Dockton springs was never in dispute and is the essential element of the discussion in the analysis used in the DEIS and FEIS.

Comment L-5-005

7. Specific issues of concern related to the advance outwash characterization are: the seven deep site borings were drilled by the air rotary drilling technique. Soil conditions were described based on periodic grab samples. Air rotary grab samples are a very gross, inexact soil characterization method. This method is not appropriate to characterize perched silt layers within the advance outwash; even using the air rotary grab sample method, evidence of silt layers or silt casts were occasionally recorded in logs for borings OBW-5, 6 and 7 (AESI 1999). Silt clasts are typical soil sample recovery from an air rotary rig when a silt layer is penetrated. The presence of silt clasts is indicative of potentially significant silt layers within the advance outwash; in a glacial environment, extensive silt layers do from within advance outwash deposits when proglacial lakes from behind ice dams. The DEIS assertion that these units are not laterally extensive is speculation; though not discussed in the DEIS, evidence of seepage above the principal aquifer is present on the site and in the section south of the site.

Landau Associates

Response

The initial monitoring wells on the site, OBW-1 and OBW-2, were drilled using a reverse air drilling technique that allows a much finer determination of the stratigraphy than is allowed by the air rotary drilling techniques. No silt layers were detected in this initial drilling activity. The other two initial exploration borings, EB-3 and EB-4, were drilled using standard hollow-stem drilling techniques and driven split-spoon samples on 5-foot intervals. EB-3 is in the same location as OBW-8, which was drilled using the air rotary technique. The logs obtained from these two explorations using different drilling methods are consistent.

Recognizing the sampling issues of air rotary drilling, however, AESI had neutron logs made of each of the new wells. The new wells, OBW-5 through OBW-9, were drilled using air rotary techniques, which allow placement of a casing large enough for pumps to be installed, which in turn allow water sampling to occur. Additional exploration was done for the Ecology study adjacent to OBW-8 and OBW-5. The results of the Ecology drilling indicate that the sediment types described by previous investigations correlate with materials observed in the new wells.

Comment

4.4.3. This section should be reviewed by an outside expert.
Kuperberg, J. Michael, Ph.D.

Response

All sections of the EIS have been prepared by independent consultants working for King County.

4.2.3 Surface Water

Comment O-1.165

4.2.3 p. 4-6. This section states that small amounts of water exit the site via springs along the beach. What is the elevation above sea level of these springs? Is there any other location on site where water is being discharged?
Ortman, David

Response

The springs have been noted to exist along the high tide level of the beach. The only possible seep observed by the County team or AESI above the high tide level of the beach is located approximately 100 feet east of OBW-9. This is an area with a ground surface elevation of approximately 30 feet. The EIS Team has not observed surface water flowing from this area, however, the vegetation indicates that the ground is wet at that point. This possible upper seep along the road may represent a local area of saturation due to concentrated runoff from the bluff road. Alternatively, this apparent zone of saturation may be the top of the capillary fringe that is present above the principal aquifer.

Comment I-7.027

There are freshwater seeps on the beach on the property which appear to flow continuously. These seeps are not discussed in the EIS and … seem to be important to … understanding … the

overall hydrogeology of the site.
Meyer, Michael

Response

The presence of these "seeps," or springs, was noted in Sections 4.2.3 and 4.2.4.6 of the DEIS. In response to public concerns, a new section has been added to the FEIS to address potential impacts to surface water (FEIS Section 4.3.6). The presence of the surface seeps supports the conclusion that the site represents a zone of discharge from the principal aquifer system to Puget Sound (Section 4.2.4.6).

Comment L-5-005 9

Also, in Section 32, directly adjacent and south of the site, Ecology has a record of 13 unnamed springs or streams. Six of these surface water features have certificate water rights. Seven have water right claims. These surface water features are important because they may represent the surface expression of perched water layers. In our opinion, the DEIS is deficient in not investigating these surface water features and correlating them with potential perched water zones within the advance outwash.
Landau Associates

Response

The water rights tracking system does contain records of unnamed springs and seeps in Section 32. Only one of these occurrences had sufficient location data to allow them to be placed within a quarter section of land. As shown on Figure 10 of Appendix A, the base of the advance sands rises towards the south. Hence the presence of springs above beach level would be expected south of the subject site. However, this stratigraphic situation, with lower permeability pre-Vashon materials rising in elevation towards the south, also forms a groundwater migration pattern that directs water from the south towards the subject site. This is schematically shown in Figure 4-5 (taken from the Ecology Mid-Study Fact Sheet; Appendix I of the FEIS). Hence springs located south of the site can be expected to exist at higher elevations than the groundwater at the site, and they would be in different flow regimes than the groundwater on the site.

Comment L-5.008

12. A spring occurs on the site that discharges from advance outwash above the principal aquifer. This spring apparently has an associated water right claim. This spring likely results from discharge of perched groundwater. The DEIS does not describe this spring or mention the water right claim. The DEIS also does not characterize spring or stream flow in up to 13 locations (based

on Ecology water rights records) in properties in the adjacent section to the site.

Landau Associates

Response

Neither the EIS Team nor AESI has noted seepage zones on the site above elevation 30 feet. More specific information about the purported seepage zone would be needed to evaluate this claim in more detail. The site of the existing water right claim is shown to be at beach level, according to Ecology files.

The EIS Team conducted visual reconnaissance of adjacent lands from public rights of way and from the beach during the wet season. No springs have been noted above the beach in the immediate vicinity of the site. This includes the bluff breaches that allow access to Sandy Shores and Gold Beach. Springs occur at higher elevations south of Sandy Shores due to the rise in the lower elevation of the principal aquifer, as defined by the lower permeability pre-Vashon sediments. The current (February 2000) Water Rights Application Tracking System (WRATS) database shows no springs different from those evaluated for the FEIS.

Comment L-5-013

14. The presence of streams and springs on record in Ecology files should be field investigated. These data should be integrated into a revised conceptual model of the hydrogeology. A revised hydrologic budget should be performed that uses documented analysis based on site specific characteristics.

Landau Associates

Response

As discussed earlier, the current (February 2000) Ecology water rights database has been evaluated and no new information was found.

4.2.4 Groundwater

Comment I-21.026

EIS 4.7. How thorough was King County's review of ground water movement?

Baker, Alby

Response

As stated in Section 4.2.1, King County used available existing data and literature on Maury Island geology, and then specified additional site-specific subsurface exploration required to provide a thorough understanding of the geologic and hydrogeologic

setting of the proposed mine site. Results from the Ecology study have provided additional details on the groundwater regime at the site, and confirmed King County's conclusions that proposed mining would not have a significant impact on groundwater.

Comment I-7.026

Has a minimum of one year of groundwater level monitoring data been collected? In the absence of such data, how can conclusion be reached regarding seasonal fluctuations in groundwater flow?
Meyer, Michael

Response

As of February 2000, a full year of groundwater level monitoring data is available.

Comment I-7.029

Has all the groundwater data collected so far been contoured?
Meyer, Michael

Response

Results from ongoing monitoring are reflected in the groundwater table maps shown in Figures 4-1 through 4-4, and in the groundwater flow map shown in Figure 4-5 of the FEIS. Results of quarterly groundwater monitoring are included in the FEIS as an addendum to Appendix E.

4.2.4.1 Overview of Basic Terms and Concepts Related to Groundwater

Comment L-5.008

13. The DEIS concludes "that none of the perched groundwater pockets would be considered an aquifer" (Appendix A, pg. 26). The DEIS definition of an aquifer is when "a significant amount of water remains in place over time" (Appendix A, pg. 6), or "a relatively large and stable underground water body formed by water saturated materials above some sort of barrier" (pg. 4-8). From a water resource perspective, these definitions are imprecise and impractical. A standard definition of an aquifer is saturated geologic material that is permeable enough to supply useable quantities of water to satisfy a particular demand such as beneficial use of wells or springs (Freeze and Cherry 1979, Driscoll 1986). Under this definition, the perched water encountered at the site would be considered an aquifer if it supplies flow to a spring that has a water right claim.
Landau Associates

Response

To reduce confusion, the FEIS has adopted Driscoll's (1986) definition of an aquifer (FEIS Section 4.3.3).

4.2.4.2 Interflow Groundwater

Comment C-8.032-1

Geology/hydrogeology—how is the conclusion reached that groundwater flows do not leave the site?

Vashon-Maury Island Community Council

Response

Groundwater flow paths depend on the three-dimensional geometry of the water table, and on subsurface stratigraphy. Both of these factors show that the eastern edge of the site is a discharge zone for the principal aquifer. In general, groundwater flows downslope, so that groundwater will flow from areas with a higher water table to areas with a lower water table. At the proposed project site, the water table gradient slopes from the northwestern quadrant of the site toward Puget Sound, roughly following surface topography. This flow path is reinforced by geology. The geologic conditions present north and south of the site direct water towards the site. The site lies in a bowl defined by lower permeability pre-Vashon Deposits. The flow pattern is shown clearly on Figure 4-5 in the FEIS and is supported by the Ecology study.

Comment L-5.007

7. NEAR-SURFACE WATER BEARING ZONE (NSWBZ). The NSWBZ is described in the DEIS as an interflow network. This zone is present within recessional outwash deposits and soil that overlie low permeability till. Groundwater flow in the NSWBZ will typically follow the slope of the land surface. On the site, flow in the NSWBZ would channel infiltrating rainfall downslope from the east end of the island towards the west. Mining would essentially eliminate this zone if it is present and have a potentially significant effect on recharge to the principal aquifer. The DEIS concludes based on direct observation and data collected by the proponents consultant that "no significant interflow network exists on the site" (pg. 4-7). Consequently, the DEIS does not evaluate the impact of the project on disruption of this zone. In our opinion, a NSWBZ does exist on the site. This zone potentially plays a significant role in recharge to the underlying aquifers. Disruption of the NSWBZ should be considered as an impact of the project that requires mitigation.

Landau Associates

Response

No significant continuous interflow network has been identified on the site.

Comment L-5.007

8. The DEIS concludes drains of higher permeability soil are present within the till that allow the interflow to drain into sands and gravels (pg. 4-7). Vertical drains within the till are not consistent with depositional processes that from till. No references are provided in the text that describes this "unique" feature of till as it occurs on the site. Furthermore, descriptions of soil from test pit logs (AESI 1999) do not describe these "drains". In our opinion it is unlikely that such a feature exists in the till on the site. The DEIS describes the till as occurring in "patches" that prevent a continuous interflow zone from developing. This description of till is inconsistent with the mapping of till extent in the DEIS (Appendix A, Figure 4). The till is described in this figure as extending over 500 feet from the downslide property boundary. Also, this figure almost certainly underestimates the extent of the till. The fact that the DEIS likely underestimates the extent of the till would also lead to mischaracterization of the significance of the NSWBZ.

Landau Associates

Response

The use of the term *vertical drains* was used in the DEIS to describe geologic conditions in layman's terms, as directed by SEPA.

Environmental impact statements shall be concise and written in plain language. EISs shall not be excessively detailed or overly technical. EISs shall explain plainly the meaning of technical terms not generally understood by the general public. [WAC 197-11-425].

The exploration logs clearly show that the till becomes thin along the northern margins of the site. In numerous test pits the till layer consists of only 3 feet of weathered and loose silty materials that would not support a perched water table. The key element in this discussion is that the till becomes discontinuous along the northern margin of the site and hence does not and cannot support a laterally extensive interflow regime.

Comment L-5.007

9. The presence of seepage and mottled soil in numerous test pits (AESI 1999) is indication that shallow saturated soil conditions exist onsite. The DEIS states that "no significant water was

encountered" in shallow monitoring wells P-1 and P-2 installed to detect the presence of a NSWBZ. This contradicts observations by the proponent's consultant (pg. 10 AESI, 1999) that "11 feet of water was observed within P-1". The fact that seepage was not detected in all test pits is not necessarily an indication that a NSWBZ is not present or not significant. The thickness of the NSWBZ will be variable from location to location and is dependant on a number of factors including permeability of the overlying deposits, slope of the underlying till, upslope catchment area, and rainfall intensity. An evaluation of all of these factors is not considered in the discussion of seepage results. Given the uncertainly associated with the NSWBZ characterization, the EIS should make conservative assumptions concerning the extent and importance of this layer to the location and timing of recharge to lower aquifers on Maury Island. The conclusions in the DEIS are apparently based primarily on the results of test pit explorations that were extended to insufficient depth to encounter the till at the base of the NSWBZ. Explorations to at least 20 ft are required to determine the presence of absence of the till (and associated NSWBZ) with a reasonable level of confidence.

Landau Associates

Response

The onsite explorations are sufficient to document the extent of the till for the EIS. The results of the shallow explorations are consistent with the existing exposures on the site and the deeper explorations on the site.

The till on the site has been demonstrated to be discontinuous. Hence any near-surface water-bearing zone (NSWBZ) will also be discontinuous. Terra Associates observed the excavation of exploratory pits EP-16 through EP-29. Our representative has observed and logged the excavation of thousands of test pits in upland areas underlain by till soils. The conclusion that no significant NSWBZ is present is based on the actual logs of the onsite explorations, direct observations made by Terra Associates, and measurements in the shallow standpipes installed by AESI. The exploratory pits were dug during January 1998 and February 1999, which is the wettest part of the year. The NSWBZ would be expected to be present at that time if it exists.

The supplemental explorations that were excavated while Terra Associates was onsite were concentrated in areas where the key element of the interflow needed to be mapped. These areas are along the margins of the site where the topography slopes towards offsite locations. In addition, exploratory pits were excavated in an area along the western portion of the site where a broad swale-like feature is present that would concentrate interflow.

Comment O-1.168

4.2.4.2 p. 4-7. This section refers to direct field observations made by the King County consulting team and on the team's analysis of data collected by AESI, a consultant hired by Taiheijo Cement Corp. Please provide a reference to the appendixes that document these "direct field observations".

Ortman, David

Response

The geology and groundwater report prepared by Terra Associates was included as Appendix A of the DEIS. Section 4.2.1 of the FEIS has been revised to clarify data sources. As noted, the King County EIS Team observed installation of five monitoring wells and 14 exploration pits, and made direct observations of geologic conditions.

4.2.4.3 Deeper Perched Water

Comment C-8.032-2

How do we know these pockets (deep perched water) are not connected or flow laterally to other sites?

Vashon-Maury Island Community Council

Response

To this point, no deep perched water has been specifically identified. Local pockets of periodic saturation may exist within the advance sands. This interpretation is based on the experience of the EIS Team that the local pockets of seasonal saturation are not laterally extensive. The fact that the central portion of the site provided an excellent exposure of the materials to be mined supports the conclusions. No seepage has been noted from within the advance sands in these existing exposures.

Comment

4.7.5. Note the careful use of "perched water" as opposed to aquifer.

Kuperberg, J. Michael, Ph.D.

Response

The FEIS has been revised to define "aquifer" more clearly (see Section 4.2.4.1 of the FEIS). Perched water is localized pockets of saturated soils that are unconnected, and do not yield economic quantities of water.

Comment L-5.008

10. PERCHED GROUNDWATER. Perched groundwater within the advance outwash is present above silt layers that interfinger with sand and gravel deposits in the advance outwash. These silt

layers slow the downward movement of infiltrating precipitation. If these layers are significant in lateral extent and thickness, they will perch and channel groundwater. Consequently, perched groundwater can impact the location and timing of recharge. Additionally, if perched groundwater discharges along a bluff face in a spring, this water would be considered a viable source of potable water that should be protected or its loss mitigated.

The DEIS recognizes the presence of silt layers and perched groundwater in the unsaturated zone and expects that local pockets of water will be encountered during mining (Appendix A, pg. 26). The DEIS discounts the potential significance of these layers because the "pockets of water are also not connected" (pg. 4-8). In our opinion, the evaluation of perched groundwater in the DEIS is not sufficient to conclude that significant perched water does not exist at the site. Mining would disrupt any perched zone, potentially affecting spring flow and the location of recharge at the site. Our specific concerns with the DEIS assessment of perched groundwater include:

- the geologic characterization of silt layers is incomplete (see above). Consequently the DEIS characterization of perched groundwater is also incomplete.

- DEIS only discusses the presence of silt layers in a general way. There is no discussion of specific evidence of silt layers described in onsite geologic logs (AESI 1999). Geologic cross sections (i e Appendix A, Figure 7) do not show evidence of silty zones logged by field geologists.

- saturated zones identified by neutron logging correlate with the elevation of silt zones at wells OBW-6 and OBW-7 (AESI 1999) The DEIS did not identify this correlation.

Landau Associates

Response

The conclusions in the DEIS are supported by the exploration logs and by observation of the actual exposures of the material to be mined within the existing mined areas on the site. No laterally extensive silt layers are exposed in the existing mine. No seepage is present from within the material to be mined in the existing mine exposures. It is speculative to believe that laterally extensive silt layers exist when none has been documented. However, due to the ambiguity noted in the neutron log in OBW-6, the County could require the Applicant to drill at least three borings and construct appropriate monitoring wells to determine if the pocket of increased moisture encountered within 50 feet of the ground surface is indeed a local perched water condition. Construction of

three monitoring wells in these three borings would resolve the issue at this location. If a perched water table that would direct water to offsite locations were present, mining plans would need to preserve the feature. Such drilling could be done with sampling at intervals of 2.5 to 5 feet to resolve the issue.

The other possible zone of saturation was noted at OBW-7. No seepage zones have been identified in the sea bluff east of this monitoring well that would correspond with these suspected perched water zones. This supports the conclusion that the zones are localized and do not recharge offsite groundwater. In addition, this monitoring well is located within a buffer area and in an area where no mining would occur. The mine would be created with slopes not exceeding 2:1 (horizontal:vertical). Hence, the possible saturation zone would not be exposed in the mine for a lateral distance of at least 200 feet. Recharge through the remaining sands would continue although some runoff may exist prior to the reestablishment of forest vegetation on the final slope. The placement of a 15-foot wide bench at an elevation of approximately 220 feet would allow infiltration of water from the area to continue.

The only significant elevated analyte found during groundwater testing to date is consistently elevated nitrate in OBW-7. Carr reports that the natural background level of nitrate on Vashon/ Maury Island is on the order of 0.1 ppm. The other monitoring wells have measured nitrate levels in this range. In OBW-7, the nitrate level has ranged from 4 to 5 ppm. Carr (1983) recommends that wells with nitrate levels above 1.0 ppm be monitored. Common sources of nitrate to groundwater include concentrated waste from farm animals, such as from chicken farms or animal barns; excessive use of fertilizer; and septic tanks. The EIS Team has not identified any barns, septic tanks, or chicken farms on the site. This leaves the higher density housing and other facilities present north of the site, together with the associated septic fields, lawns, and possible farm animals, as the most credible source of the nitrates. If there was a significant aquitard or silt layer present that would direct infiltrating water away from the site, then the same aquitard or silt layer would direct the nitrate-impacted water away from the site. This does not appear to be the case. Instead, the subsurface conditions appear to be directing the water that infiltrates the ground north of the site to flow towards the site.

Finally, the northern portion of the mine contains the last two cells that are proposed for this mine. These cells would not be mined for several years. This provides adequate time to install additional borings if the County feels additional information is required

before allowing mine cells 5 and 6 to be developed. Two new monitoring wells could be established to evaluate this condition. As an alternative, the mine could proceed to elevation 225 and supplemental shallow exploration could be done.

Comment L-5-005

10. neutron logging done by AESI at three site borings detected the presence of perched water at three separate depth intervals (AESI 1999). In each case, perched water correlated with evidence of silty layers in the advance outwash. These data suggest that silt layers are extensive enough to result in saturated soil conditions within the advance outwash above regional groundwater. The DEIS incorrectly only mentions two of these saturated intervals (pg. 4-8). In our opinion, neutron logging should be performed in all deep site wells.

Landau Associates

Comment L-5.008

11. Neutron logging, while apparently effective at identifying potential perched layers, was only performed at three of the seven onsite monitoring wells.

Landau Associates

Response

Neutron logging involves lowering a radioactive source down the well. Neither OBW-1 nor OBW-2 was designed or constructed to allow neutron logging. Washington State laws are quite specific on the use of radioactive sources and would not allow the use of neutron logging in these two older wells. OBW-8 was drilled adjacent to EB-3. EB-3 was drilled in 1998 and no monitoring well was constructed. EB-3 was drilled using the hollow-stem auger drilling technique and driven core samples on 5-foot intervals. Hence, direct supplemental soils logging adjacent to OBW-8 exists, and thus supplemental geophysical logging was not determined to be required. OBW-9 was drilled near the toe of the sea bluff. This well encountered the principal aquifer at a depth of approximately 19 feet. No significant information would have been obtained by performing a neutron log for the short distance of unsaturated materials at this location.

4.2.4.4 Aquifers

Comment I-16.001

With what precision are the dimensions of the aquifer known?

Berry, Evan

Response

Additional characterization performed as part of the Ecology study supports the conclusions about aquifer geometry in the EIS. Due to the inevitable uncertainty, the analysis and mitigation measures required for this project are conservative in nature. Ongoing monitoring would be required and the project would be revisited by King County after 5 years of operation to determine the nature of any actual measured impacts and to verify the effectiveness of mitigation measures implemented. The wells constructed for this study have been field located by licensed surveyors and the groundwater measurements are made to within 0.01 foot.

Comment I-11.002

The exact size, shape and location of the aquifers of Vashon-Maury Islands are not completely understood and all of them are supplied by groundwater recharge.

Elizabeth Parrish/John Rees

Response

As a result of the proposed mine, significant additional information has been developed by the Applicant, the King County team, and the Ecology study. All of the information available as of June 2000 is relatively consistent. New data that may become available would be used in preparing the final project design and development plans.

Comment O-1.173

4.2.4.4 p. 4-8. Please clarify the statements describing the "upper aquifer" (or principal aquifer) and the "lower aquifer".

Ortman, David

Response

The FEIS has been modified to provide additional clarification of these terms in accordance with commonly used hydrogeologic descriptions for the Vashon/Maury Island area. The principal Aquifer is defined by Carr as being present within Unit II and the deep aquifer is present within Unit III. Unit II is identified by Carr as being the advance sands. Unit III is defined by Carr as being older deposits that predate the Vashon deposits. The deep aquifer is reported by Carr to exist in granular soils within Unit III. Carr goes on to report that the deep aquifer is at 100 to 300 feet beneath sea level. For the current study, the term *principal aquifer* is used to describe water that is contained within advance sands. The term *deep aquifer* is used to describe groundwater obtained from soils that are stratigraphically beneath (older than) the advance sands. However, soils that are older than the advance sands can have significant hydraulic continuity with the advance sands.

Comment O-1.174

Where on Maury Island have two distinct aquifers been identified? Is it correct that the upper "aquifer" water level in the vicinity of the site can be as high as 90 feet (above sea level)? Where two distinct aquifers exist, what is the normal lower elevation of the "upper aquifer"? What is the normal upper elevation of the "lower aquifer"? What is the normal lower elevation of the "lower aquifer"?

Ortman, David

Response

The aquifers are identified based on their presence in either the advance sands, the primary aquifer, or in deeper or stratigraphically older sediments, the deep aquifer. Most wells on Maury Island draw their water from the deep aquifer. The advance sands are limited in extent due to the presence of pre-glacial soils and topography that precluded a uniform widespread deposition of the advance sands. The normal lower elevation of the primary aquifer is the elevation of the base of the advance sands. This elevation varies widely on Maury Island, hence an average elevation would have no meaning. The upper and lower elevation of the deep aquifer varies based on site-specific stratigraphy. As discussed above, a strict interpretation of the Carr Report limits deep aquifers to granular soils at about 100 to 300 feet below sea level. None of the static water levels for any of the aquifers is lower than sea level.

Comment C-8.032-3

Conclusions are not supported by data. If the primary and deep aquifers are one continuous system at the site, what are the implications?

Vashon-Maury Island Community Council

Response

It is a conservative assumption to assume hydraulic continuity between aquifers, since any impact on the upper aquifer would necessarily impact the deep aquifer if they are hydraulically connected. Indeed, it must be a default assumption unless significant information and data suggest otherwise. In any event, recharge to the deep aquifer is assumed by Carr (1983) to be from the principal aquifer.

Comment O-1.166

4.2.4.1 p. 4-7. This section states that based on the analysis conducted for this EIS, three main groundwater bodies have been identified in the vicinity of the site: (1) an interflow network; (2) the principal aquifer, and (3) the deep aquifer.

Ortman, David

Comment O-1.167

Please explain why it states on this page that there are three distinct groundwater bodies when it states on p. 4-8 that at the project site the aquifer at the Lone Star site can be thought of as one continuous system?

Ortman, David

Response

The presence of three groundwater bodies being present on the site is consistent with the Carr model for the groundwater conditions that are present on Vashon/Maury Island. The apparent lack of a "classic" lacustrine clay or silt layer beneath the site is not in accordance with the Carr model but is not precluded by the nature of glacial erosion and interglacial and glacial sediment deposition. There is undoubtedly a significant aquitard at some depth beneath the site. However, the assumption that the principal and deep aquifer having significant hydraulic continuity is a conservative assumption and underscores the need to preserve groundwater resources.

Comment L-5.009

15. Data presented in the DEIS are not sufficient to modify conclusions from previous studies that suggest the hydraulic continuity between these two aquifer zones is limited by aquitard deposits. The DEIS should reevaluate geologic data from the USGS and Carr (1983) studies and more precisely describe geologic conditions that define the principal and deep aquifers. If necessary, additional borings should be drilled that extends through the expected depths of the principal aquifer, underlying aquitard into the deep aquifer.

Landau Associates

Response

The assumption that the principal and deep aquifer may have higher hydraulic conductivity than assumed by Carr is a conservative assumption since the deep aquifer is more susceptible to impacts from potential changes in the recharge regime if no significant aquitard is present.

Comment O-1.175

If the aquifer at the Taiheijo Cement Corp. is one continuous system please provide a cross-section showing the entire aquifer that sits below the site.

Ortman, David

Response

A cross-section is not necessary to evaluate probable adverse environmental impacts. It must be recognized that the deep aquifer is not a single laterally continuous geologic unit. The deep aquifer

is a grab basket created by Carr to describe deep water-bearing zones that are not within the Vashon age deposits and are stratigraphically beneath the Vashon advance sands. As discussed above, the intent of the Carr study was to describe water-bearing zones that exist 100 to 300 feet below sea level. The Carr study does not have a specific name for the aquifer that exists in older sediments above sea level. It is possible that there is a significant aquitard beneath the site and that there is a deeper aquifer present.

Comment I-21.003

Why will the permit process not be held up for the Vashon/Maury Island Aquifer Study?

Baker, Alby

Comment

Given the risks of the project, it would seem not only prudent but essential to at least wait for the results of the state aquifer study and for the opinions of independently hired consultants before granting a grading permit.

Parker, Judith W.

Comment

Lonestar proposes to mine within 15 feet of an acquifer which is the sole source of water for the island. The State has appropriated money to conduct a study of the acquifer and of the potential impacts of the mining on the acquifer. How the County publish a draft EIS on the project without either conducting its own hydrological study or waiting for the results of the State-funded study. This is not a minor issue. The draft EIS does not adequately address and has inconsistent conclusions regarding the impact of the mining on acquifer recharge and the potential for contamination of the acquifer by arsenic that is known to exist in the soil and other hazardous substances (such as fuel leaking from the mining equipment).

Boyle, Karen

Comment

Lone Star's proposed expansion would impact Vashon/Maury Islands' water resources. The site is a critical recharge area and the draft Environmental Impact Statement is inadequate in its analysis of the islands' sole source aquifer. Please educate yourself regarding the need for further study as seen and funded by Washington state officials for $250,000.00 state dollars for this sensitive aquifer.

Saunders, Karen and Peter

Comment

We are most concerned by the statement, "Surface water from the mining operation would infiltrate to the underlying aquifer via the proposed retention/infiltration pond. (6.3.4.1) With the presence of

arsenic and other contaminants brought to the site by trucks the potential for contaminating our aquifer is too great to take such a risk. We are too dependent on our aquifer to even consider that it could be adversely affected to the point we would have no water. The Dept. of Ecology should be allowed to conduct its study before any further discussion of a permit for Lone Star.

Michael & Marlene Rossi

Response

King County determined that sufficient technical information exists to evaluate the probable adverse impacts of the project. The results of the Ecology study have been incorporated into the FEIS. Results from the Ecology study are consistent with the conclusions of the EIS. Results of Ecology's numerical simulation models of the groundwater regime at the site provide additional details on the impacts of mining on the recharge regime at the site. These numerical simulation models, additional data from Ecology, and factual data from any other sources that become available would be used during project design.

The presence of arsenic and other metal contaminants is discussed in Chapter 10 of the EIS. No evidence of leaching of arsenic or other metals at the site has been found. The proposed containment berm would isolate contaminated soils in an impermeable berm, further reducing the risk of mobilizing arsenic and other metals. This finding was confirmed by Ecology.

The potential impacts due to the use of vehicles and fuels are analyzed in Sections 4.3.2.1, 4.4.3.7, and 4.4.3.8.

4.2.4.5 Static Water Levels

Comment O-1.178

This section says that static water levels at the site are based on "wells established for this EIS and on previous wells". Please clarify and identify which wells were established for this EIS and which ones are previous wells.

Ortman, David

Response

Section 4.2.1 of the FEIS has been revised to clarify sources of information. OBW-1 and OBW-2 were drilled in 1988 to support project planning. OBW-5 through OWB-9 were drilled following the scoping of the DEIS.

Comment O-1.206

It states that static groundwater levels would be determined by measuring levels in monitoring wells. What wells are being referred to here? Where are these wells located? What is the Groundwater Monitoring Plan? What agency is requiring it? To whom would fluctuations in the aquifer be reported.

Ortman, David

Response

A groundwater monitoring plan would be required by King County as a condition of the mining permit. Details of the plan would be reviewed and approved by King County before mining could commence. Groundwater levels would be measured in the existing monitoring wells at the site and any new monitoring wells that may be built on the site. The County could also require ongoing monitoring of the water levels in the offsite Ecology wells constructed as part of their study. These offsite monitoring wells are public property.

King County would require that all monitoring data be provided at least quarterly to the County.

Comment O-1.176

4.2.4. 5 pp. 4-8/4-9. First it states that the static water level (top of aquifer) is not fixed, but changes in response to climatic change and human influences, then states on p. 4-9 that the water level is relatively stable and that the water table at the site is expected to fluctuate only a few feet over the course of a year. On what documentation are these "expectations" based?

Ortman, David

Response

These statements are not contradictory. *Static water level* defines the groundwater elevation at the time the measurement is made and not a constant elevation throughout the year or throughout time.

The expectation that static water levels at the site usually range over several feet is based on groundwater measurements taken at the site, and on the location of the site with respect to local stratigraphy. Figures 4-1 through 4-4 of the FEIS show static water levels measured quarterly, from February to December 1999. These figures show that water levels have varied only a few feet on site. In addition, the site lies in a "bowl" formed by pre-Vashon age topography underlain by materials with lower permeability. This is documented in the USGS map, in the Ecology study, and in onsite explorations.

Comment C-8.032-4

What are the implications of static water levels from 90' to 20' above sea level? How do we conclude the site is a point of rapid discharge?

Vashon-Maury Island Community Council

Response

The static water levels clearly show radial flow from the center of the island towards the Sound (see Figure 4-5 of the FEIS). As shown by Ecology, the groundwater flow divide is located offsite towards the west. Discharge from the site is documented by the USGS map, which indicates that the advance sands and hence the principal aquifer extend below sea level in this area. In addition, springs are present on the beach below the high tide level, which illustrates the discharge of water from the principal aquifer to the Sound.

Comment O-1.191

4.3.1 p. 4-15. This section states that the materials that would be mined are located above the aquifer. However, in Sec. 4.4.1 it states that the site would be excavated to an elevation of 50 to 70 feet. However, according to Figure 4-1 the Static Water Level on the site is as high as 80 feet. Therefore, it appears that Taiheijo Cement Corp. is actually planning to excavate material within the aquifer. Is this correct?

Ortman, David

Response

The FEIS has been revised to clarify that a minimum 15-foot buffer would be maintained between the bottom of the mine and the top of the water table. The mine elevations indicated in the DEIS predate the existing static water levels available from ongoing groundwater monitoring. Final mine elevations would be developed during the design phase of the project incorporating the latest available groundwater monitoring data. In addition, King County would require a groundwater monitoring plan, and final mine contours would be established as mining progresses to ensure that a minimum 15-foot buffer were maintained between mining activity and the top of the groundwater table.

Comment

"It appears that the contour map of static water level shown in Figure 4-1 was created by linear interpolation of only seven data points and a lot of guessing. That the proponent would offer such a picture of groundwater under such a complicated surface makes the whole report suspect. This is too critical an issue to treat in such an unreal and simplistic manner. The livelihood of several hundred people depend upon protection of aquifers in the mining

area, and more rigor needs to be applied before permits are issued.
Fitch, Bob & Madeline

Response

The contours of the static water level were generated using onsite observation wells in accordance with locally accepted practice. The groundwater data in the county study is supported by the mapping and numerical simulation model done independently for the Ecology study.

4.2.4.6 Aquifer Recharge

Comment I-3.004

DEIS does not adequately address: the recharge/discharge area of the watershed
Pearce, Judith Wood

Comment

4.10.3. The status of the site with regard to groundwater discharge/recharge needs to be determined conclusively.
Kuperberg, J. Michael, Ph.D.

Response

King County has determined that sufficient information exists to evaluate likely adverse impacts. As discussed in the DEIS, the project site includes a groundwater discharge zone, as evidenced by the presence of springs along the beach. Section 4.2.4.6 of the FEIS has been rewritten to incorporate preliminary results from the Ecology study, which confirms the groundwater flow paths assumed in the DEIS.

4.2.4.7 Adjacent Wells

Comment

4.11.4. What is the basis for the "discharge directly into Puget Sound" finding?
Kuperberg, J. Michael, Ph.D.

Response

Springs located along the beach empty directly into the Sound. It follows that subsurface flows discharge directly into the Sound. This is consistent with the results of the Ecology study.

Comment L-5-005

8. Seepage was noted by Landau Associates during a December 1998 site visit between about 40 to 80 ft elevation. Lone Star NW has a water right claim for a spring in Section 28 (T22N, R3E) (that includes the site) that is apparently a reference to this spring. The spring, though obvious during our site visit, was not observed

by the DEIS Team ("no surface water features were noted on the site", Appendix A pg. 3).

Landau Associates

Response

The County team has not observed any seepage zones above elevation 30. It is possible that there are local pockets that may seep during significant rainfall. No factual evidence of higher seepage zones has been presented.

The Glacier Northwest water right (Water Right Claim 104741) is located near the toe of the slope in the vicinity of OBW-9. Nothing in the water rights claim information suggests that the water right is for a spring that is higher on the bluff. Rather, the water right claim file contains a map that points directly to seeps near the beach at the toe of the slope for the source of the water for the water right claim. Additional comments and responses on the Glacier Northwest Water Right Claim appear in Section 4.3.1, under the heading "Glacier Northwest Water Right Claim."

Comment I-7.030

Has the groundwater data been correlated to the pumping cycles of the nearby wells?

Meyer, Michael

Response

The adjacent wells are expected to cycle on and off. Given the nature of the soils and the distance to the adjacent wells, it is unlikely that any measurable drawdown would be measured at the Glacier Northwest site corresponding to withdrawal at those offsite wells.

Comment

The proposed largest gravel mine ever in Washington State will produce absolute reality, a vast hole, Yet the EIS fails to match that reality with equal certainty about human water supplies, concluding with such hesitant statements as above and: "While no drinking wells are suspected of being downgradient" What confidence can citizens have in aquifer protection when the understanding of the island's sole source aquifer has been the subject of debate for a dozen or more years and even the site specific studies paid for by Lonestar cannot assure the fate of an adjacent subdivision's wells?

Kuperberg, Joel

Response

The FEIS has been revised to clarify the location of water wells relative to groundwater flow at the Glacier Northwest site. Figure 4-5 shows that groundwater from the site flows into Puget Sound. No wells are located down-gradient of the site.

Comment I-7.031

Do the drawdown induced by the nearby wells cause any changes in gradient and flow direction … that could lead to movement of potential contaminants from the mine site to the wells? Meyer, Michael

Response

As shown in Figure 4-5 of the FEIS, groundwater from the Lone Star site flows toward Puget Sound. No wells are present between the proposed mine and Puget Sound. Moreover, as discussed in Chapter 10, the proposed mining would not result in contaminants entering groundwater. The proposed voluntary cleanup action instead would reduce the likelihood that contaminants would leave the site since contaminated topsoils would be isolated and placed within a containment cell.

Comment L-5.009

17. The DEIS presents conflicting information concerning a groundwater flow direction and groundwater divides in the principal aquifer. The groundwater divide is described as occurring "somewhere south of the Lone Star site" on page 4-11. In Appendix A (pg. 12) the DEIS concludes that the Gold Beach wells are located "on the northern limb of a groundwater mound that is present immediately north of the Lone Star site and the Gold Beach wells". Essentially, the DEIS describes the groundwater divide as occurring both north and south of the site in different parts of the report. In describing the divide, the DEIS fails to reference actual water level data from site wells or integrate these data with standard concepts of island hydrology. Site water level data (Appendix A, Table 1) indicates that a groundwater divide occurs near the west end of the Lone Star property near wells OBW-6 and OBW-5. The DEIS should present a characterization of groundwater flow patterns and a groundwater divide that is consistent with site data and hydrogeologic concepts. The DEIS should reconsider its assessment of impacts of the project after this reevaluation.

Landau Associates

Response

A groundwater flow map from the Ecology study is included as Figure 4-5 of the FEIS. The elevation of water in the Gold Beach wells is similar to the elevation of water beneath the Glacier

Northwest site at an equivalent distance from the beach. Groundwater contouring done for this study and the Ecology study shows clearly that groundwater from the Glacier Northwest site does not flow towards the Gold Beach wells. Moreover, groundwater measurements in the DEIS (Appendix A, Table 1) are consistent with the interpretation in Figures 4-1 to 4-5 of the FEIS.

Results of the Ecology study support the conclusions of the DEIS with regard to the groundwater divide and general groundwater flow patterns. The relatively steep gradient between OBW-5 and OBW-6 (as evidenced by the data in the DEIS, Appendix A, Table 1) supports the radial groundwater flow pattern shown in Figure 4-5. Figure 4-5 of the FEIS supersedes prior speculation and supports the conclusions about groundwater flow in the DEIS.

Comment C-8.032-6

Appendix A, pp. 9 and 10 suggest the possibility that instead of discharging, the site serves to recharge the deep aquifer. Support conclusions made. Adjacent wells—isn't flow radial from the higher elevations? Aren't each of these sites down gradient from the highest elevations and first to be mined areas? Provide further information on the recharge regime of the island, with diagrams and radial flows anticipated in the recharge area.

Vashon-Maury Island Community Council

Comment C-8.032- 8

Provide diagrams of the water divide and radial recharge, and identify how Sandy Shores spring is recharged, if not from the site.

Vashon-Maury Island Community Council

Comment C-8.032-7

Sandy Shores—how do we know there is a water table higher than the 90' at the Lone Star site? Is it more likely that any water divide is located on the Lone Star property and all sites are down gradient from the project site?

Vashon-Maury Island Community Council

Response

A diagram showing the water divide and radial recharge pattern for Maury Island in the vicinity of the proposed project site is given in Figure 4-5 of the FEIS. As discussed earlier, the site is situated in a bowl formed by lower permeability pre-Vashon deposits. These deposits rise both north and south of the site. The groundwater flow in the principal aquifer is directed towards the site from both the north and south. There is no dispute that the principal aquifer may serve to recharge the deep aquifer. In the analysis for the FEIS, it has been assumed that there is significant hydraulic connection between the two aquifers. This is a conservative assumption.

The conclusions in the DEIS are supported by the results of groundwater measurements in the Ecology study (Pacific Groundwater Group 2000). Springs could be expected south of Sandy Shores at elevations above the beach since the upper level of the lower permeability pre-Vashon sediments rises to the south (as shown in Appendix A of the DEIS, Figure 10). The principal aquifer is draped above these lower permeability pre-Vashon sediments

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Comment O-1.182

This section states that the Sandy Shores well static water level is near 61 feet and that it is cross-gradient, or roughly at the same level, as the water table at the proposed site. There are no drawings that support this statement and it can not be verified from the sketchy figures provided in the DEIS. Please provide a clear drawing that shows the static water level for each of these four major well systems in relation to the static water level of the site currently and with the proposed action.

Ortman, David

Response

The DEIS included maps showing the location of Sandy Shores relative to the project site (Appendix A, Figure 9); the stratigraphic relationship between Sandy Shores and the project site (Appendix A, Figure 10); and the static water level at the project site based on February 1999 groundwater monitoring (Figure 4-1). Figures 4-1 through 4-4 of the FEIS show the static water level on the project site during four quarterly monitoring periods. A groundwater flow map from the Ecology study is included in Figure 4-5 of the FEIS. These figures, and the data in Appendix A of the DEIS, show that the Sandy Shores Wells are located cross-gradient of the project site.

Comment C-8.032-9

Won't mining tend to drain the Hake Springs site?

Vashon-Maury Island Community Council

Response

Hake Springs are located above the highest level of groundwater encountered on the site. In addition, as shown in the Ecology study (Pacific Groundwater Group 2000), groundwater from the area of Hake springs moves towards the north.

Comment

Section 4.2.4.6 discusses that recharge occurs in a radial pattern. If recharge occurs in a radial pattern centered on the highest and central most portion of the island, why is Dockton Springs' recharge not impacted by the proposed operation, or Alternatives 1 or 2?

Nelson, Sharon K.

Response

As shown in Figure 4-5 of the FEIS, Dockton Springs and the project site are located on opposite sides of the groundwater divide.

Comment L-5.009

14. The principal aquifer at the site consists of saturated sand deposits in the base of the advance outwash and upper portions of Olympia interglacial deposits Carr (1983) and Ritzi (1983). This aquifer occurs directly above sea level in saturated freshwater deposits. Analysis in the Vashon-Maury Island Ground Water Management Plan (GWAC 1995) attempts to further subdivide the principal aquifer into hydrostatigraphic zones. The DEIS typically uses the terminology of Carr (1983) and Ritzi (1983). According to Carr (1983) most of Vashon and Maury Island's wells are screened in the principal aquifer. However, on Maury Island in the vicinity of the site, the majority of wells appear to be screened below the principal aquifer in the deep aquifer. This assessment is based on depth of residential wells calculated from driller's well log information (see Appendix A). The apparently low use of the principal aquifer for well water supply on portions of Maury Island can be attributed to the thin and low to moderate permeability of these deposits. Still, the principal aquifer is likely a primary source of spring water supply on Maury Island. The primary source for the Dockton Water Association, the Dockton springs, likely discharges from this aquifer. Also, recharge to the deep aquifer is from the principal aquifer. The DEIS only presents a general characterization of the principal aquifer. In our opinion, this characterization is not adequate to address the potential impact of the project on the island drinking water supply. Our specific concerns include:

- The thickness of the principal aquifer is not characterized in the DEIS. A well can not efficiently extract water from a permeable saturated deposit unless saturated thickness is sufficient to facilitate use of standard pump technology. Consequently the thickness of the principal aquifer represents a primary risk variable that should be characterized in the DEIS.

- The DEIS indicates that the aquitard at the base of the principal aquifer "has not been specifically identified or encountered in the borings performed on-site" (Appendix A, pg. 10). In our opinion, the presence of this aquitard can be inferred based on information provided by Booth (1991) and Carr (1983). Also, the saturated Olympia interglacial deposits are likely to have very low permeability that may not support water resource development. It may be appropriate to specifically measure the hydraulic parameters of the soil horizons that make up the principal aquifer to provide a basis for determining aquifer thickness. Alternatively, the final EIS analysis should assume that the Olympia interglacial deposits are not part of the principal aquifer.

- The DEIS suggests that the principal and deep aquifers may be in hydraulic continuity and that this would explain similar water levels in the Iliad and Sandy Shores wells (Appendix A, pg. 10). Based on their depth, these two wells are likely both screened in the deep aquifer.

Landau Associates

Response

The key criterion in analysis of impacts is preservation of the groundwater resource available for existing beneficial uses of groundwater. The EIS is not intended to provide construction details or guidelines for offsite wells. Even if wells on the Glacier Northwest site had extended deeper to some significant aquitard unit, as can be seen on Figure 10 of Appendix A in the DEIS, the elevation of a lower permeability unit (referred to as undifferentiated pre-Vashon sediments) varies widely across the Island.

There is no dispute that the Iliad and Sandy Shores wells appear to be screened in the deep aquifer. To assume a high degree of hydraulic continuity between the principal and deep aquifer is a conservative approach and is the approach that has been used in the analysis in the FEIS.

As noted above, Dockton Springs and the project site are located on opposite sides of the main groundwater divide on the island and therefore activity at the project site would have no effect on Dockton Springs.

As documented in the Ecology study, under the worst-case scenario, a slight decrease of flow to Dockton Springs relative to current conditions could occur over the long term due to reforestation of the site. However, the Ecology analysis did not include the mitigation measures identified in the FEIS. The

mitigation measures would reduce the impacts. In addition, the impacts anticipated by the Ecology study would likely not be measurable when put in the context of normal seasonal and annual variations of groundwater flow. A comparable decrease of flow at Dockton Springs would occur over the long run under No-Action.

Comment L-5.009

18. The DEIS concludes that the Dockton Springs "are located in a permeable soil unit within the pre-Vashon sediments". In our opinion, this assessment is not reasonably supported by data and evaluations in the DEIS. This assessment contradicts geologic logging by the USGS in the area of the spring as well as the hydrogeologic assessment by Carr (1983). Furthermore, it is unlikely that soil units within the interglacial deposits could support recorded spring flows. According to the Dockton Water Association, the spring source produces up to about 75 gallons per minute. Actual discharge at the spring is likely much greater when accounting for uncaptured subsurface flow. Carr (1983) estimated that recharge to saturated deposits within the Olympia interglacial deposits at 1 inch per year. Total recharge over the entire Maury Island to the deep aquifer would be equivalent to about 250 gallons per minute (assuming the surface area of Maury Island to be about 200,000,000 square feet). Based on these assumptions, and a straightforward mass balance analysis, the Dockton spring would represent discharge from a third to a half of the total island recharge to the deep aquifer (or equivalent) deposits. This is not a plausible scenario. The DEIS characterization of the Dockton spring is speculative and calls in to question any assertions in the DEIS concerning potential impacts on the spring.

Landau Associates

Response

The DEIS assumed a high degree of hydraulic conductivity between the aquifer present on the Glacier Northwest site and the aquifer that feeds Dockton Springs, regardless of the name of the specific aquifer involved. Hence a lengthy debate on the name of the aquifer is not needed.

As noted elsewhere, Dockton Springs is located on the opposite side of the groundwater divide from the project site (Figure 4-5 of the FEIS).

Comment L-5.009

19. Additional geologic field mapping, an additional well near the Dockton spring, and reevaluation of the new and existing data should be completed prior to distributing the final EIS to address

discrepancies between the DEIS and other available hydrogeologic information. Alternatively, conservative (protective) assumptions regarding the hydrogeology and recharge of the spring should be built into the final EIS analysis.

Landau Associates

Response

King County has used all available information, and believes the available information is sufficient to evaluate impacts. Conservative assumptions related to hydraulic connectivity have been adopted.

Comment L-5.009

20. The DEIS states that the Dockton spring elevation (30 ft) is "equivalent to elevations in the principal aquifer at the Lone Star site" (Appendix A, pg. 11) and, therefore, "the Lone Star site is not a recharge body for the Dockton Park Springs". Water levels measured in wells OBW-1, OBW-2, OBW-5, and OBW-6 (Appendix A, Table 1) are between 48 and 86 ft elevation indicating that flow from the site to the spring is possible and even likely. Again, the hydrogeology of the principal aquifer relative to Dockton spring should be reevaluated prior to submittal of the final EIS.

Landau Associates

Response

Results of the Ecology study support the conclusions of the DEIS with regard to the groundwater divide and general groundwater flow patterns. Figure 4-5 shows Ecology's interpretation of groundwater flow and supersedes prior speculation. These latest data are consistent with the groundwater flows assumed in the DEIS.

Comment O-1.181

4.2.4.7. Please produce a separate map showing the four major well systems. The Gold Beach wells can not be found on Figure 9 of Appendix A.

Ortman, David

Response

The Gold Beach wells are identified as B-1 and B-2 on Figure 9 in Appendix A of the DEIS.

4.3 Impacts

Comment L-5.013

13. IMPACTS AND MITIGATION SUMMARY. The DEIS lists five reasons why the project will not have an impact to drinking water (Table S-3). In our opinion, these reasons are either not substantiated in the DEIS or not germane to assessing the ultimate impact. Additionally, the DEIS does not adequately characterize the hydrogeology or the current and future beneficial uses of water on the island in the vicinity of the project site. Consequently, conclusions regarding an impact have a very large uncertainty associated with them. The level of uncertainty is in our opinion unacceptable given the sole source and fragile nature of the groundwater resource on Maury Island. In our opinion, the elimination of the near surface water bearing zone, the elimination of perched aquifers, the change in the timing of recharge and the location of recharge that will be caused by the project present a potentially significant risk to drinking water supplies on Maury Island. This risk has not been adequately characterized or addressed by proposed mitigation measures. Consequently, we have the following recommendations for the final EIS. Additional site investigations should be performed to adequately characterize the hydrogeology. These investigations should include drilling additional wells (in compliance with Ecology well regulations) using soil sample techniques appropriate for detecting and describing thin silt layers. Alternatively, the final EIS should include conservative assumptions regarding the site hydrogeology.

Landau Associates

Response

As discussed earlier, the analysis has used a conservative approach. Additional site exploration will be done as part of the final design of the mine.

Comment

I am very concerned that we are a sole source aquifer. Currently Maury and Vashon Island are experiencing difficulties with water. The removal of the sand and gravel, our storage unit, will seriously undermine our aquifer. This projection has been born out by numerous studies, provided to you by Nelson, Sharon.

Nebeker, Susan

Response

Impacts due to removal of overburden are analyzed in Section 4.3.1. Mining would cause changes in the seasonal timing of recharge, but impacts would be limited to the site, and would be neither significant nor adverse.

Comment

I request that the Lone Star permit application be denied as these actions do not conform to the King County Comprehensive Plan. Specify King County Comprehensive Plan policies which support this request for denial, are as follows:

Section CP-1211 of the King County Comprehensive Plan which states:

"Special consideration should be given to the impacts of new development on the Island's groundwater resources. This should apply to major developments, development in high groundwater recharge areas, or development near public water supplies."

Section NE-302 which states:

Development should occur in a manner that supports continued ecological and hydrologic functioning of water resources. Development should not have a significant adverse impact on water quality or water quantity. On Vashon Island, development should maintain base flows, natural water level fluctuations, ground water recharge in Critical Aquifer Recharge Areas and fish and wildlife habitat.

Section NE-309 which states:

"Beginning in 1995, King County shall implement the 1994 Puget Sound Water Quality Management Plan to restore and protect the biological health and diversity of the Puget Sound Basin."

Jake Jacobovitch, president, Vashon-Maury Island Council

Response

Impacts to groundwater resources are a prime concern to King County. Analysis in Chapter 4, and extensive studies conducted by Ecology have found that the proposed mining activity would have no significant adverse impact on groundwater levels, and no adverse impacts on water supply wells. Therefore, the proposed mining activity does not violate the cited King County policies.

Comment O-1.200

Geology is defined as the study of the structure of the earth. A significant adverse environmental impact of Taiheijo Cement Corp's proposed project is the physical removal of a portion of Maury Island. This is a major geological change to one of our Puget Sound islands that is irreversible. Please add to this section a discussion of the geological impacts of removal of a significant portion of Maury Island.

Ortman, David

Response

The geological impacts of removing the sand and gravel have been addressed in the EIS documents. The impact that has been identified is the attenuation of storm water flows and infiltration of the precipitation to the principal aquifer.

Comment G-5.010

10. Why hasn't the geological/hydrological interactions of moving 10% of Maury Island and placing them at SeaTac Airport over a short period of time been evaluated?

Citizens Against SeaTac Expansion

Comment C-7.008

Why hasn't the geological/hydrological interactions of moving 10% of Maury Island and placing them at SeaTac Airport over a short period of time been evaluated? The geology department of the University of Washington should be requested to assess impacts based on their recent test conducted in the Sound. If the Maury Island aquifer becomes contaminated, how long will it take to contaminate the unconfined regional aquifer?

Brown, A.

Response

Discussion of impacts at potential offsite locations would be addressed in the analysis of individual offsite projects, as discussed in Chapter 1.

King County has determined that the EIS Team is qualified to evaluate geologic impacts. However, Ecology has been directed by the legislature to conduct an independent review of the impacts of the mine. Results from the Ecology study have been incorporated into the FEIS. Additional information that would become available later would be used in the final project design.

Mitigation measures identified in the FEIS would mitigate the potential for environmental contamination of the groundwater. The Maury Island aquifer does not contribute flows to any off-island aquifer.

Comment I-6.014

How will the effect on the water supply be predicted/monitored?

Gorski, Alan

Response

Throughout the life of the mine, additional monitoring would be done to allow for changes in design of the final contouring plan and infiltration facilities, as necessary.

4.3.1 Would mining as proposed affect recharge of the aquifer system or affect the availability of water to residents on Vashon/Maury Islands?

General

Comment C-1.001

The DEIS does not adequately analyze and characterize the hydrogeology of the island and the risk the mine poses to the water supply of the island. Additional well sampling is required, further study of the potential for seawater intrusion is necessary, and the characterization of the recharge of the site to adjacent springs is inadequate.

Nelson, Sharon

Response

Additional well sampling has been performed. A new section (4.3.4) has been added to the FEIS to address public concerns about saltwater intrusion. In addition, results from the Ecology study have been incorporated into the FEIS. The Ecology Fact Sheets have been incorporated as Appendix I to the FEIS. Recharge to adjacent springs is discussed in the context of identifying the key springs and the discussion of the geologic conditions and flow patterns within the principal aquifer.

Comment I-6.010

What quantitative evidence is there to justify the removal of till layers considering the effect it will have on the hydrogeologic system of Maury Island?

Gorski, Alan

Response

Only one till layer has been identified on the site. This till layer is not a continuous layer. As shown in Figure 4-5, the site is not a recharge zone for offsite wells. Indeed, the hydrogeologic system of Maury Island results in offsite locations recharging (flowing towards) the groundwater beneath the site.

Comment O-1.217

4.6. p. 4-18. The DEIS has failed to display a clear picture of the geology and hydrogeology impacts of the proposed project. The entire Maury Island aquifer needs to be mapped and an analysis made of how removal of a significant portion of the island will alter the existing water table. Please provide such an analysis.

Ortman, David

Comment I-3.017

The Maury Island Water Supply should be part of the EIS considerations before the Lone Star operations are permitted and implemented. … The effects of the discharge/recharge area should be analyzed.

Pearce, Judith Wood

Comment I-5.001

The EIS fails to adequately evaluate the potential threats that this mining activity poses to the Maury/Vashon Island sole source aquifer

Davis, Jennifer

Comment I-4.003

Grading of the site will have deleterious consequences on the hydrogeology of the area … interfering with the recharge of the aquifer.

Gylland, Barbara and Fred

Response

The Maury Island water supply is a primary concern of King County, and potential impacts are evaluated in Chapter 4. King County has determined that sufficient information exists to evaluate likely adverse impacts. Potential impacts to aquifer recharge are evaluated in Section 4.3.1, and potential mitigation measures to offset changes in aquifer recharge at the project site are identified in Section 4.4. Groundwater flow on the island in the vicinity of the project site is mapped in Figure 4-5 of the FEIS.

Comment I-1.009

Groundwater processes relating to the sole-source … aquifer … would be altered by the project … and in violation of the current groundwater management plan. … the applicants understanding of groundwater dynamics at the site is speculative (the groundwater study is needed here).

Shipley, Frank

Response

The FEIS contains additional groundwater data that address the requirements of the Groundwater Management Plan. Analysis of these data shows that no significant impacts would occur to the aquifer that would affect offsite wells or springs. Results from the Ecology study confirm these findings.

Comment

The Draft Environmental Impact Statement does not provide adequate scientific data to support conclusions reached that the island's sole source aquifer would not be damaged by removing half the width of the island. Residents of Maury and Vashon Islands derive their water from the sole source aquifer under the

islands. Damage to this aquifer or to its recharge would be irreversible. Thankfully, the state legislature has funded a study to determine more carefully the nature of the recharge and maintenance of the aquifer.

Means, Gary

Response

King County has determined that sufficient information exists to assess adverse impacts. Results from the Ecology study support the conclusions in the FEIS; the Ecology Fact Sheets are incorporated as Appendix I of the FEIS. Additional groundwater monitoring data collected since publication of the DEIS (included in the FEIS as an addendum to Appendix E), and a numerical simulation model developed by Ecology, are also consistent with the analysis in the DEIS.

Comment I-11.001

The following needs further consideration: Section CP-1202 of the King County Comprehensive Plan states: "all land use policies and regulations for Vashon shall reflect the overriding importance of the fact that the whole island is the recharge area for a single-source aquifer. All of Vashon Island shall therefore be considered a groundwater recharge area.

Elizabeth Parrish/John Rees

Comment

I request that the Lonestar permit application be denied as these actions do not conform to the King County Comprehensive Plan. Specific King County Comprehensive Plan policies which support this request for denial, are as follows:

Section CP-1202 of the King County Comprehensive Plan which states:

"All land use policies and regulations for Vashon shall reflect the overriding importance of the fact that the whole Island is the recharge area for a single - source aquifer. All of Vashon Island shall therefore be considered a groundwater recharge area."

Jake Jacobovitch, president, Vashon-Maury Island Council

Comment I-1.020

… the risk level and environmental effects, and the effects on possible future community groundwater needs are not addressed.

Shipley, Frank

Response

The effect of mining on the Maury Island aquifer is one of the key issues addressed by the EIS, and is one of the primary reasons an EIS has been prepared for this project. Extensive effort has been undertaken to characterize the hydrogeologic regime at the site and

determine what impacts the proposed mining activity would have on groundwater resources. These efforts include a review of existing well logs from throughout Maury Island, installation of new monitoring wells, onsite ongoing quarterly groundwater monitoring, subsurface trenching onsite, and the Ecology study. Results from all of these sources reveal consistent findings: mining as proposed would not adversely affect the quantity or quality of groundwater resources on Maury Island.

Recognizing the overriding importance of groundwater supplies, the EIS Team has identified a number of mitigation measures in Section 4.4 to mitigate potential changes in the groundwater recharge regime.

Comment [The project] could tamper with the aquifer which could threaten the water supply on the whole island …
Bennett, Dr. Forrest C. and Barbara

Response Comment noted. Results in Chapter 4 show there would be no adverse impact on water supplies.

Comment "Finally, because of the critical need for water, if Lone Star feels so confident that they will not endanger our water supply, require them to post a bond, or to formally insure island residents against such a catastrophe, or to provide an acceptable alternate means to provide us with water."
Fitch, Bob and Madeline

Response The applicant could be required to post financial guarantees per KCC 16.82.170.

Aquifer Recharge

Comment C-12.010 (part 1 of 2) Drainage and recharge—who determines appropriate drainage and recharge design?
St. George, Brian

Response Final mine design, including the grading plan and design of recharge facilities, would be reviewed and approved by King County prior to commencement of mining. Section 4.4 of the FEIS identifies mitigation measures that the County could consider as conditions of granting a grading permit.

Comment C-8.011

The DEIS suggests benches could be constructed so as to encourage infiltration rather than directing water to a single retention/infiltration pond. If the site is a discharge area, why would recharge and infiltration be required? The design for this system is not included in this proposal.

Vashon-Maury Island Community Council

Comment

If the site is a groundwater discharge point, to where will site stormwater infiltrate? To where will the stormwater retention pond infiltrate?

Kuperberg, J. Michael, Ph.D.

Comment O-1.186

The second reason given is that the site is in a discharge area of the aquifer, rather than a recharge area. This appears to be contradicted by a number of other statements in the DEIS, including the statement on p. 4-7 that rainfall continues to move downward to recharge the aquifer. Therefore, this second reason appears to be incorrect. Please change the discussion on p. 4-12 to reflect this concern.

Ortman, David

Comment O-1.195

Aquifer recharge/Proposed Action: This summary, as well as the discussion in the DEIS is extremely poorly written. For example, the Proposed Action section states that "(1) appropriate drainage and recharge designs would be used" but then states further that "(3) the site is located within a groundwater discharge area rather than a recharge area." Why would a recharge design be used if the area is not a recharge area? If this is not a groundwater recharge area, why does the EIS state on page 4-7 that " … rainfall continues to move downward to recharge the aquifer below?"

Ortman, David

Comment O-1.196

(part 1 of 2) Aquifer recharge/Proposed Action: This section states that "the site is located within a groundwater discharge area rather than a recharge area". If this is a groundwater discharge area, where is there evidence of groundwater discharge on the site? Why does Table 4 in Appendix A (p.16) clearly document a recharge component to this site?

Ortman, David

Comment O-1.197

Aquifer recharge/Alternative 1: Again, this summary claims that the site is located within a groundwater discharge area rather than a recharge area. But under Alternative 1, 2, and No-Action it states that "effects of increased recharge through vegetation removal would occur over a longer period". Why is increased recharge mentioned if the area is a discharge area rather than a recharge

area?

Ortman, David

Response

Sections 4.2.4.6, 4.3.1, and 4.4 of the FEIS have been modified to clarify the groundwater recharge regime at the site, and to clarify mitigation measures. As stated earlier, although the site is not within a recharge area for offsite wells, it remains an important part of the groundwater resource on Maury Island. Precipitation that falls on the site and infiltrates the ground recharges the principal aquifer. The eastern portion of the site, along Puget Sound, is a discharge area of the principal aquifer, as evidenced by the presence of springs and seeps along the beach. As discussed in Section 4.3.1, mining could alter the timing of aquifer recharge at the site. Section 4.4 identifies mitigation measures, including a revised drainage and infiltration plan, to mitigate these potential changes.

Comment L-5.009

16. The DEIS concludes, "the site appears to be a discharge zone for water from the principal aquifer" (pg. 4-11). This apparent determination is used as one justification for the conclusion that there will be no effects to drinking water from the project (Table S-3). A standard definition of a recharge zone is "that portion of the drainage basin in which the net saturated flow of groundwater is directed away from the water table" (Freeze and Cherry 1979). Based on this definition, only a small portion of the principal aquifer adjacent to Puget Sound is likely a discharge zone. The vast majority of the site is a recharge zone for the principal aquifer. A straightforward flow net evaluation of a water table aquifer with annual recharge from precipitation would verify this concept at the site. Given the size of the site relative to the landmass of central and south Maury Island, the site should be considered an extremely important recharge zone for maintaining viable water supplies in the area. The failure of the DEIS to recognize this fact undermines the conclusion that the project will not impact water supplies. The EIS should perform an analysis of the flow in the principal aquifer such as a numerical model simulation that is capable of simulating recharge and discharge patterns in the principal aquifer before and after implementation of the project. This assessment should be completed prior to reaching conclusions regarding project impacts on drinking water supply.

Landau Associates

Response

The Ecology study included a numerical simulation of the aquifer. The results of the simulation are consistent with the qualitative analysis performed by the EIS Team.

Comment O-1.180

It states that looking at the site within the context of Maury Island, recharge generally occurs in a radial pattern centered on the highest and central-most portions of the island. Since this recharge includes the proposed site, why does Table S-3 state that the site is not a recharge area?

Ortman, David

Response

The site is located well downgradient of existing wells. As such, the site is not a recharge area for offsite wells.

Comment L-5.011

12. Infiltration from the surface to the principal aquifer is estimated in the DEIS to take up to a year or more (pg. 4-12) based on data presented by Carr (1983). The DEIS also concludes that this time lag would be reduced to as little of 20 days on the site due to mining. The DEIS addresses recharge issues, but the evaluation and discussion are incomplete and superficial. A more thorough and quantitative assessment of the impact of mining on aquifer recharge should be prepared for the final EIS.

Landau Associates

Response

As demonstrated in the DEIS, the mine has increased recharge at the site. This increased recharge would continue to occur throughout the life of the mine. The final mine reclamation plan would need to have infiltration facilities balanced to attenuate the changed infiltration rates (see Section 4.4.3.2). Ecology developed a numerical model of groundwater flows at the site, and this model would be used in the final mine design.

Depending upon the final design-level studies, runoff that is generated above the top of the mine may need to be infiltrated along the upper elevations. One or two mid-slope benches could be created to allow runoff that may develop on the final mine slopes to infiltrate at elevations above the floor of the mine. The primary infiltration facilities in the floor of the pit should be located in the western portion of the mine.

Comment O-1.177

Currently, the existing geology of Maury Island acts as a sponge: "rainwater takes up to a year to slowly percolate down through the sands and gravels until finally hitting the water table." Taiheijo Cement Corp. proposes to remove this sponge. Thus, rather than taking a year for rainwater to percolate, rainwater will move much more quickly through the 15 ft. layer that remains. It would seem that the water table would undergo much more extreme

fluctuations depending on the monthly rainfall totals than what is suggested in this section. Is this correct?

Ortman, David

Response

The term *sponge* has been eliminated from the FEIS. The language in the DEIS was used to describe geologic conditions and concepts in a nonscientific manner, but more standardized scientific terminology is used in the FEIS. Section 4.3.1.1 of the FEIS has been revised to reflect the increases in total recharge, the changes in timing of recharge, and the potential increases in fluctuation in groundwater levels that would result from the proposed action. Section 4.4 includes additional mitigation measures to reduce variations in groundwater levels during and following mine operations.

Comment

The report regarding aquifer recharge states that there will be no effect on local drinking water supply related to aquifer recharge, however common sense tells me that removing large amounts of sand and gravel can alter aquifer recharge and could deplete or even dry up wells. Especially when Lone Star is planning to mine down to 15 feet above the aquifer. If residential building permits require a 25 foot buffer from a pond, or other wetland area, I think at least a 25 foot buffer should be required for the aquifer, but a 50 foot buffer would be more assuring.

de Guzman, Kristine R. and Carlo B.

Response

The thickness of the buffer is described in the FEIS in Section 4.3.2.1. The requirements for this project exceed the recommendations contained in the Vashon-Maury Island Groundwater Management Plan, Section 2.3.9 under SG1, item 4. Item 4 of SG-1 recommends that groundwater level and quality be monitored when the depth to seasonal high water is reduced to 5 feet or less.

Comment L-5.011

12 The DEIS does not present an analysis of the impact of mining on the location of recharge. Currently, infiltrating recharge would tend to be channeled offsite downslope and to the west by interflow within the NSWBZ. It is likely that silt layers within the unsaturated zone would also tend to channel infiltration westward. This assumes that layering within the advance outwash tends to dip towards the west consistent with an alluvial source towards the center of Puget Sound and consistent with assessments by Ritzi (1983). The net effect of both the NSWBZ and the silt layers

would be to concentrate recharge towards the western portion of the site and nearer Dockton Spring. Current water level data trends are consistent with this assessment (e g the highest water levels in the principal aquifer occur along the west boundary of the site). The mine would essentially eliminate the hydrologic effect of these two features while at the same time concentrating recharge along the east boundary of the site beneath the proposed infiltration pond. The shift in the location of recharge will result in shift of the current groundwater divide on the island eastward. This shift will likely have the net effect of causing groundwater levels in the western part of the aquifer to decline. This may have a significant effect on Dockton spring flow as well as other beneficial uses along the western shore of the island. The final EIS should include and evaluation of the impact of a change in recharge location caused by the mine. This evaluation should consider the use of a numerical groundwater flow model to quantify the potential magnitude of this effect.

Landau Associates

Response

The DEIS clearly states that the eastern infiltration pond shown on the current plans would not be suitable for use in the final mine operations or reclamation plan, and development of a revised infiltration plan is included as a mitigation measure (FEIS Section 4.4.3.2). Infiltration facilities would need to be dispersed throughout the site, and be concentrated along the western portion of the mine. The local mounding that would occur beneath the infiltration facilities would dissipate in a radial manner, and not only towards the sound. A numerical simulation could be required by King County as part of the final design process.

Comment

The analysis should evaluate recharge under final reclamation conditions. Predictive simulations should be performed regarding the impact of modifications to the location and timing of recharge. These simulations should be performed using a calibrated groundwater flow model. The simulations should include a sensitivity analysis to account for uncertainty in site characterization. Based on additional Site characterizations and analysis, a revised impact assessment should be performed.

Landau Associates

Response

Detailed simulation models are not required to evaluate potential impacts to the groundwater system. King County would require ongoing groundwater monitoring throughout the life of the project to verify that mining activity was not negatively affecting the aquifer at the site. Ecology has developed a groundwater flow

model, and the results of that model would be incorporated into the mine design and groundwater monitoring plan.

Comment I-1.013

project impacts … increase in recharge at active project site by about a factor of 10.

Shipley, Frank

Comment I-1.021

That "recharge would not be significantly altered" is not necessarily true—it will increase substantially downslope.

Shipley, Frank

Response

Increasing the amount of recharge could be considered a beneficial impact that would occur over the life of that proposed mine provided that infiltration is managed in accordance with the mitigation measures identified in Section 4.4.3 of the FEIS.

Comment O-1.196

(part 2 of 2) Why does it state in Sec. 4.1 Appendix A (p. 21) of the Terra Associates report that "the proposed mining will affect the recharge patterns on the site"? Why did Jones & Stokes surpress this conclusion in the DEIS?

Ortman, David

Response

No information was suppressed in the DEIS. The DEIS summarized the contents of Appendix A. Section 4.3.1.1 of the DEIS identifies several changes to recharge patterns that would result from the proposed action.

Comment L-5.001

1. The size of the project is very large relative to the aerial extent of the island. Approximately 5 percent of the approximately 4,700 acre island would be directly impacted by the project. The mine would extend approximately half way across the width of the island and remove over 80 percent of the soil column above the water table in some areas. Recharge of the island aquifer system is wholly from precipitation falling on the island itself. Pressure on the island's finite water resources is increasing through increased usage. The mining project has the potential to reduce the actual supply of water by significantly impacting aquifer recharge.

Landau Associates

Response

As discussed in Section 4.3.1.1 of the FEIS, total recharge would increase in actively mined areas due to removal of vegetation and

the corresponding reduction in interception and transpiration, although variability in the static water level would increase. Measures identified in Sections 4.4.2 and 4.4.3 would mitigate these impacts.

Comment L-5.011

11. RECHARGE ASSESSMENT. Recharge to groundwater on Maury Island is wholly from infiltrating precipitation. Only a portion of rainfall will actually infiltrate to the underlying aquifer system. The remaining portions will either runoff, evapotranspirate or replace soil moisture storage in the unsaturated zone. Carr (1983) estimated the infiltration rate to the principal aquifer as about 4 inches per year. The DEIS provided an independent assessment of recharge that suggested current recharge rates of about 10 inches per year for undisturbed areas of the site based on total precipitation of 40 inches per year. Infiltration in Puget Sound typically only takes place at the surface between about November and April. However, actual recharge to the principal aquifer at the site likely occurs at a relatively constant rate. This is because of the thick unsaturated zone that occurs in the advance outwash sand and gravel deposits. Water moving through these deposits moves along variable pathways and at variable rates due to geologic hetrogeneities and layering with the ultimate effect of producing a relatively constant rate of recharge.

Landau Associates

Response

The actual amounts of recharge used in the analysis is consistent with the estimates used by Carr (1983). The larger estimate used in this analysis is due to the lack of a continuous till mantle on the site and the associated runoff. Section 4.3.1.1 evaluates the changes in the infiltration regime that could arise as a result of the proposed action. The final design of the mine would include incremental infiltration where needed. For example, runoff generated above the mine would need to be infiltrated above the mine at native grades. At least two mid-slope benches could be created to serve as infiltration facilities for runoff that may develop during reforestation on the mine slopes. Infiltration facilities in the floor of the mine could be placed to allow the maximum amount of infiltration to occur along the western, inner margin of the mine. The final details would be determined during the final design.

Comment L-5.011

14. Currently, the thick unsaturated zone of sand and gravel buffers recharge to the principal aquifer. This zone essentially acts as a storage zone for infiltrating winter precipitation, resulting in a

relatively constant rate of recharge to the principal aquifer throughout the year. Consequently, aquifer water levels show minimal seasonal effects (Appendix E). Spring flows such as the Dockton spring (according to the Dockton Water Association) remain relatively constant throughout the year. Similarly, well yields should not be impacted by low rates of precipitation in the summer and early fall. The DEIS describes this storage effect as "the existing sand and gravels act to measure the downward flow of water into a relatively stable flow as it reaches the groundwater table" (pg. 4-12). The DEIS also acknowledges that the project would reduce this storage effect. "The decrease in recharge time would cause variation in the quantity of water entering the aquifer at any given time. During rainy periods, recharge would be relatively high, and during dry periods, recharge would be relatively slow" (pg. 4-12). Though the DEIS acknowledges that removing the storage capacity of the unsaturated zone will result in variations in the water table, these variations are discounted "because the amount of water entering the groundwater table would not change" (pg. 4-13) even though "locally a steeper groundwater gradient would occur". We have significant concerns with the DEIS assessment of the impact of seasonal recharge. These concerns include: the DEIS states that variations in the groundwater table will be "localized" (pg. 4-13). This appears to be a subjective judgement as no calculations or technical literature was referenced. Given the size of the project both in absolute terms and relative to the size of the island, our expectation and professional judgement is that the effect will not be localized. The DEIS states that "localized variations will be about 5 feet". Once again, a reading of the DEIS suggests this assertion is subjective and without technical basis.

Landau Associates

Response

Infiltration facilities are in use throughout King County and requirements for the design of infiltration facilities are contained in the King County Surface Water Design Manual. Mounding would occur beneath the infiltration facilities. However, the mounding would dissipate radially. In addition, increased infiltration would occur due to the removal of the forest. Hence, although a locally steeper gradient would occur, it would be offset by an increased amount of water available for recharge. The final numerical simulations to predict the amount of mounding could be required as part of the design phase of the project. However, as discussed in the DEIS, the infiltration facilities would need to be located towards the western, inner portion of the mine to mitigate the increased gradients.

Comment L-5.011

13. The recharge assessment apparently does not consider the impact of steep mined slopes on runoff; the recharge assessment was not preformed for final mined conditions. The recharge assessment does not consider that a significant portion of the site is proposed for an impermeable cap (onsite arsenic disposal) that will reduce infiltration and increase runoff; recharge under final reclaimed mining conditions should be considered. Under this scenario, total infiltration rates could decrease. The final EIS should contain a site specific hydrologic budget calculation that focuses on the net effect of the project on the quantity of recharge. This assessment must take into account the most likely final site configuration including steep slopes, infiltration pond and impermeable surfaces.

Landau Associates

Response

The FEIS has been revised to more specifically address issues related to steep slopes, slope stability, and impermeable surfaces. Section 4.3.5 has been added to the FEIS specifically to assess impacts due to potential problems with slope stability. Section 4.3.1 has been revised to provide more detail on the potential changes to the recharge regime at the site, including the affects of steep slopes and the proposed retention pond. And Section 4.4 has been revised to provide additional details on mitigation measures to avoid and lessen these impacts. These measures include a revised drainage plan that (1) takes into account post-mining contours; and (2) includes multiple, smaller, temporary water storage ponds on the upper mine slopes where impermeable surfaces would exist.

The EIS Team agrees that the use of a single infiltration pond as proposed by the Applicant would result in the adverse impact of an altered recharge regime and possible surface water flows into Puget Sound (see FEIS, Sections 4.4.3.1 and 4.4.3.3). The DEIS acknowledged that infiltration facilities would need to be dispersed throughout the mine property. The mitigation measures identified would result in a drainage plan in which all runoff generated at the site would be infiltrated onsite for the 100-year flood, or whatever design conditions the County specified.

Finally, a site-specific hydrologic budget is not needed. As discussed in Section 4.3.1, total recharge would increase temporarily under the proposed action due to removal of vegetation, and gradually return to pre-project conditions as reclamation vegetation communities developed.

Comment C-8.033

Won't lowering the water table at the project site tend to drain the high gradient recharge areas around the site? If the site is merely a discharge area, why are the benches being designed to allow infiltration? The EIS says that up to 10 times as much rainwater may enter the ground to recharge underlying aquifers compared to a forested area … however, recently cleared ground is much more likely to shed rainwater.

Vashon-Maury Island Community Council

Response

Although significant amounts of water are discharged from the site, the groundwater that is present is an important element of the groundwater resource on Maury Island. No measurable lowering of the water table would occur as a result of the proposed action. Total recharge to the aquifer would temporarily increase. Due to the highly porous nature of surface material at the site, all precipitation would continue to infiltrate. In parts of the mine where impervious surfaces are introduced, mitigation has been identified to develop infiltration facilities to accommodate the increased runoff (FEIS Section 4.4.3.2).

Comment L-5.011

13. The DEIS performs a qualitative hydrologic budget to estimate recharge prior to and during mining (Appendix A. pg. 12). The budget indicates that recharge will increase during mining. In our opinion this recharge assessment is not adequate for predicting impacts to water resources from the project for the following reasons: the recharge assessment does not appear to be based on site specific parameters. Apparently the assessment uses data generated for "till catchments" in Puget Sound (Appendix A, pg. 13).

Landau Associates

Response

The use of data from the USGS study on till catchments is appropriate for this current level of analysis. The USGS study was performed in areas with similar elevation, similar vegetation, and similar precipitation.

Comment L-5.011

15. The assertion in the DEIS that the amount of recharge will not change is not supported in the document. The hydrologic budget (Appendix A, pg. 16) apparently only considered undisturbed and active mine area recharge. The final EIS must provide an accurate assessment of recharge after mining prior to reaching conclusions regarding the net impact of the site on recharge. The assertion in the DEIS that the amount of recharge will not change is not

directly relevant to the evaluation of the seasonal effect on recharge caused by mining. The relatively rapid recharge of the aquifer in the winter will result in higher groundwater levels, higher groundwater gradients and higher groundwater discharge rates to Puget Sound during the winter. Conversely, water levels will be lower in the summer, maximum well yields and spring flows will also be less. If this impact is significant enough, these sources of water supply will become unreliable as a year round resource. Therefore, it is important that the final EIS address the magnitude of this effect, in combination with other recharge effects, in a quantitative way that relies on defensible hydrogeologic methods that are thoroughly documented in the final report. It is likely, in our opinion, that a numerical groundwater flow model will be the most effective approach to quantifying recharge impacts given the complexities in the hydrogeologic system, uncertainty associated with site characterization, and the need to evaluate transient (time varying) effects.

Landau Associates

Response

Numerical modeling performed for the Ecology study would be used as part of the final mine design (see Section 4.3.1.1). King County could also require ongoing verification of the numerical simulation, and adjustments to the facilities and operations as dictated by the actual performance data. In any case, a Groundwater Monitoring Plan would be developed and implemented as part of any final mine design.

Comment

4.13.3. This paragraph refers to 20-acre mining cells. Previously the cells were said to be 32 acres (with another 32 acres in restoration). Coupled with previously restored 32 acre cells, which are still maturing, how many acres will be infiltrating at this accelerated rate at any one time and over how many years?

Kuperberg, J. Michael, Ph.D.

Response

This factual error has been corrected in the FEIS. Active mining cells would cover 32 acres. The area under reclamation would depend on the rate of mining. At maximum extraction rates, the site could be completely mined in 11 years, with the entire mine area covered by immature vegetation.

Comment

The draft environmental impact statement has technical errors in Chapter 4 that result in false conclusion that there will not be significant impacts resulting from the proposed project. The issue

concerns aquifer recharge which the authors of the DEIS correctly note depends on the depth and texture of the material lying above static groundwater levels. The proposed project will reduce the thickness of the material overlying the aquifer at the site and, as a result, will lead to greater fluctuations in groundwater levels - particularly during wet periods because the travel time of water from the ground surface to the aquifer will be reduced. The authors conclude that the reduced travel time will not affect the quantity of water recharging the aquifer (see page 4-13).

While it is true that the quantity of water entering the aquifer will not increase as a result of the proposed project, the higher groundwater levels during periods of recharge will increase increase the rate and volume of water naturally discharged from the aquifer. Consideration of a simple mass balance is considered (same inflow + more outflow = less storage) and the most basic principle of groundwater flow, d'Arcy's law that discharge is proportional to hydraulic gradient (in this case the difference between the elevation of the groundwater table and its point of discharge) indicates that there is a very high likelihood that the proposed project will increase groundwater discharge and reduce aquifer storage.

Konrad, Christopher P.

Comment

Furthermore, the proponent treats lightly the issue of recharge. It is not possible that a major section of the overburden of the aquifer can be removed without affecting the flowrate into it nor the groundwater static level profile, not only at the site, but in adjacent areas (Sandy Shores, Gold Beach, Iliad, and Dockton wells) where water is withdrawn. It gets more serious when consideration is given to yearly fluctuations in rainfall. No evaluation of extended-period drought (typical of Western Washington variations) has apparently been performed. The proponent wants to mine within 15 feet of the aquifer. Rainfall would percolate through this overburden in as little as 20 days (DEIS pg. 4-12, para 4.3.1.1.) The present burden over the non-mined portion of the site provides a holding capacity of about one year during which the rainfall percs down to the static water level. The loss of such surge capacity in recharge could prove disastrous by allowing draw-down during the dry season from outflow to Puget Sound. The flows from adjoining parts of the aquifer into the created cavity would increase, drawing those levels down as well.

Fitch, Bob & Madeline

Response

The Ecology study has determined that a nominal decrease in groundwater levels relative to current conditions would occur as a result of the mining operation. This decrease is a result of the

assumed reforestation at the site following mining. The actual impacts should be immeasurable when considering seasonal and annual variations that will occur in the static water levels. A similar reduction in groundwater levels would result under No-Action.

Infiltration

Comment G-2.012

12. 4.3.1.1. If the filtration rate for rainwater will be 25% faster than historical levels, how will this affect the discharge rate into Puget Sound? What marine biology will be affected? What research has occurred to evaluate this impact?
Washington Environmental Council

Response

The infiltration facilities would be designed to maintain the rate of discharge of groundwater into Puget Sound. There would be a temporary increase in the discharge rate. However, it must be remembered that the ultimate fate of all water in the primary and deep aquifer is eventually Puget Sound. The fresh water that does flow into Puget Sound is rapidly dispersed through tidal action and currents in the sound.

Comment

4.12.5. Define the term "measure" with regard to the downward flow of water. How will the removal of material affect "measure"?
Kuperberg, J. Michael, Ph.D.

Response

"Measure" means to reduce variability. Removal of material would reduce the measuring effect and increase variability in the rate of recharge, as discussed in Section 4.3.1.1 of the FEIS. Mitigation measures to reduce this impact are outlined in Sections 4.4.3.2 and 4.4.3.4.

Comment I-21.038

How can "rain water infiltration" despite "discrete phases of cell construction" not be a factor especially during heavy rainfall from November then June?
Baker, Alby

Response

Infiltration from individual mine cells would increase the amount of water that recharges the aquifer. Hence the impact can be considered a beneficial impact providing additional water for the groundwater resource that exists.

Comment I-7.032

Changing the surface topography will also change the flow pattern of surface water. This will change not only when infiltration occurs, but where it occurs.

Meyer, Michael

Response

Since there is no surface water on the site except for springs at the tide line, no impact on surface water flow would occur. The final design of the mine would control the location of significant recharge zones.

Comment I-7.034

… with only 15 feet of material over the groundwater surface, percolation of surface water to groundwater could be much more rapid than 20 days along preferential pathways such as soil discontinuities, soil fractures, and animal burrows.

Meyer, Michael

Response

This will be analyzed and the results incorporated into the design process and construction of the infiltration facilities.

Comment I-1.014

project impacts … reduction of recharge infiltration time for about a year to about 20 days.

Shipley, Frank

Comment I-1.015

project impacts … major increase in variability in aquifer recharge and static level.

Shipley, Frank

Response

These impacts are evaluated in Section 4.3.1.1. The decreased time of recharge could be mitigated by incremental recharge throughout the mine as discussed in Section 4.4.3.

Comment G-2.011

11. 4 3.1.1. With an increased recharge rate, what is the potential for full saturation of the principle aquifer if the rate of filtration is faster then the rate of discharge? What would be the impact of full saturation?

Washington Environmental Council

Response

The impacts to the recharge regime are discussed in Section 4.3.1.1. As noted, the project would result in increased infiltration during active mining, and thus there would be increased saturation of the principal aquifer in the vicinity of infiltration facilities. As noted in Section 4.3.1.1, the water table would

display localized increases and decreases in groundwater level in the immediate vicinity of recharge facilities. If full saturation of the buffer between the floor of the pit and the surface occurred, the groundwater would surface and flow to Puget Sound as surface flows. Mitigation measures identified in Section 4.4.3 would prevent this impact. Groundwater monitoring would be required as part of any grading permit. Final mine design would take into account any changes in groundwater level that occurred, and provide sufficient native soils to maintain a minimum 15-foot buffer between the mined surface and the top of the water table, taking into account any localized groundwater mounding. In addition, the infiltration facilities would be dispersed across the site to reduce the impacts of mounding.

Comment O-1.187

The third reason given is that mining would not affect the amount of water entering the groundwater table. Jones & Stokes has failed to characterize or quantify the increase in the rate of discharge from this site due to the removal of most of the overlying material. In addition, Jones & Stokes has failed to provide a model of the water table off site as impacted by the proposed project. Please provide an estimation of the impacts of the proposed action on the rate of discharge from this site and provide a figure that shows the impact of the project on Maury Island's water table off site.

Ortman, David

Comment O-1.188

The fourth reason given is that the amount of rainwater entering the ground would actually increase. As stated above, Jones & Stokes has failed to provide any information concerning the impacts on the rate of discharge from this site due to this increase. Please provide this information.

Ortman, David

Response

With increased infiltration as a result of removal of the forest and its transpiration, there would undoubtedly be a corresponding increase in discharge. There could also be an increase in recharge of the deep aquifer. King County does not consider this impact adverse. Increased surface discharge would result in increased flow from seeps and springs located near the tide line. The amount of the increase would not be sufficient to create erosion or sedimentation problems.

Perched Water

Comment I-7.028 It appears that there is a significant storage capacity in the "isolated pockets" of groundwater above the principal aquifer, and that this storage would be lost during mining.
Meyer, Michael

Response As discussed in the FEIS, no measurable decrease would occur in the amount of water recharging the aquifer. No perennial water bodies would be eliminated through this action. Geo/Hydro Mitigation 1 (Section 4.4.3.2 of the FEIS) would incorporate incremental infiltration facilities to mimic the existing infiltration regime and to mitigate for changes in topography. Potential decreased storage capacity would be taken into account during design. The storage capacity that may currently exist serves to attenuate recharge to the aquifer. The incremental infiltration facilities identified in Geo/Hydro Mitigation 1 would attenuate infiltration and recharge of the aquifer and mitigate this potential impact.

Comment I-1.010 project impacts … elimination of perched water table.
Shipley, Frank

Response The County team has identified no widespread or laterally continuous perched water body on the site.

Comment I-12.003 How can one justify simply writing off the upper lenses of water?
Chasan, Daniel Jack

Response The upper lenses of water have not been "written off." The loss of local areas of seasonal perched water have been included in the analysis used in the EIS.

Springs

Comment I-1.011 project impacts … removal of most recharge till above beach springs.
Shipley, Frank

Response The beach-level springs are not directly fed by the interflow that may exist above the till. The beach springs are fed by lateral flow from the principal aquifer as it discharges into Puget Sound.

Comment I-9.010

EIS fails to fully evaluate and address … the possibility of creating additional surface water discharge points through the exposure of new springs is ignored by the EIS.

Mackey, Cyndy

Response

As discussed in the FEIS, local seeps could occur. However, based on the existing information, none of the local seeps would be springs that exist on a year-round basis or that would continue to manifest themselves following mining.

Wells

Comment I-10.001

Excavation of the type that Lone Star is proposing will have impacts on both wells and the Dockton system

Adams, Charles

Response

The impacts to the groundwater system have been analyzed and appropriate mitigation measures have been presented in the DEIS and the FEIS. The analysis preformed by the EIS Team has been corroborated through an independent study by Ecology on the nature of the hydraulic connection between the site and Dockton Springs. The groundwater flow patterns shown on page three of the Ecology Mid-Study Fact Sheet (Appendix I of the FEIS) correspond with the interpretations in the DEIS (Section 4.3.1.1 and Appendix A). "The [Ecology] survey results also suggest that the main source of recharge to Dockton Springs lies outside of the mine site." (Appendix I of the FEIS).

In addition, quarterly groundwater monitoring would be required as part of any grading permit, and mining plans would be revised should any significant impact to groundwater resources be identified.

Comment I-7.033

What are the new groundwater contours going to be? How can you be certain that the new flow patterns will not adversely affect the availability of water to local wells?

Meyer, Michael

Response

The County would require that the project be designed to continue the same general groundwater flows that exist at this time. The County could require a numerical simulation to model the groundwater conditions. The numerical simulations would be a design-level effort to balance infiltration and runoff on the site.

The numerical simulation would incorporate existing project data, data from the Ecology study, and any other new information that becomes available. Based on the existing information, the final groundwater contours shown on Figures 4-1 through 4-4 would remain relatively unchanged, although seasonal variation could likely increase (Section 4.3.1.1 of FEIS).

Comment O-1.185

p. 4-10. It states in this section that groundwater beneath the site may eventually flow toward the Iliad well and contribute to this recharge. If this is the case, why does Table S-3 state that the site is not a recharge area?

Ortman, David

Comment O-1.184

pp. 4-12/4-13. This section states that there are four additional reasons that impacts on drinking water would not occur. The first reason given is that the site does not contribute to a lateral interflow network that directs water offsite. This appears to be contradicted by the statement on p. 4-10 which states that the Iliad well may be downgradient, meaning that some groundwater beneath the site may eventually flow toward this well and contribute to recharge. Therefore, this first reason appears to be incorrect. Please change the discussion on p. 4-12 to reflect this concern.

Ortman, David

Comment O-1.190

Once again it states that water movement is toward Puget Sound and away from any well sites. This appears to be contradicted by the statement on p. 4-10 which states that the Iliad well may be downgradient, meaning that some groundwater beneath the site may eventually flow toward this well and contribute to recharge. Therefore, this statement appears to be incorrect.

Ortman, David

Response

Section 4.2.4.7 of the FEIS has been revised to clarify the relationship of the Illiad Well to the groundwater network at the proposed project site. There is no known or suspected interflow between the site and the Iliad Well. The EIS analysis is based on the conservative assumption that hydraulic continuity exists between the principal aquifer on the Glacier Northwest site and the deep aquifer. Thus, the site is assumed to contribute to groundwater recharge to the principal aquifer. This recharge is recognized as an important resource and part of the principal aquifer.

Because the Illiad Well is considered to have its inlet in the deep aquifer, recharge at the site can be considered as contributing to the Illiad Well. However, as shown on Figure 4-5 of the FEIS, the site is downgradient or cross-gradient hydrologically from adjacent beneficial water users, including the Illiad Well. Potential changes in the recharge regime at the site are discussed in Section 4.3.1.1. These changes would not impact the Illiad Well since total recharge originating at the site would increase.

Comment I-1.016

project impacts … unspecified impacts to existing possibly down-gradient well (possible future wells not considered).

Shipley, Frank

Response

No existing beneficial water use located downgradient of the proposed project site has been identified.

Comment

The DEIS is inadequate and fails to address significant issues and/or data including:

1. The hydrogeologic study failed to include wells off the property, towards QuarterMaster Harbor. Thus, the study fails to adequately analyze recharge and its impact on the island. Further, the failure of Jones and Stokes to provide well logs and AESI's memorandums, information (referenced in the EIS but not included in the EIS) was a major deficiency in the document.

Huggins, Alan R.; verbatim comments from Cynthia and Kyle Cruver

Response

The county study included representative off-site wells and springs. The results of the EIS correspond very well with the results of an independent study performed by Ecology. There are some slight differences in interpretation of stratigraphic names of geologic units between the EIS and the Ecology study; however, the net impacts correspond.

The EIS includes considerable technical data. As stated in the Fact Sheet in the DEIS, additional background data was made available for public review during the comment period at the offices of King County DDES and Jones & Stokes.

Comment L-5.012

14. The DEIS (Appendix A, pg. 10) discusses the potential impact of the project on specific beneficial uses (Gold Beach wells, Sandy Shore well, Dockton spring). However, the DEIS does not document all beneficial uses. The DEIS relies on AESI (1998) for a summary of existing water rights. However AESI (1998) provides only a partial list of water rights. Specifically, no water right claims are documented in the AESI report. Based on the Ecology Water Rights Application Tracking system (WRATS) database, over half of the water rights in the sections surrounding the site that were evaluated in DEIS (See Appendix A, Figure 9) are water right claims. The DEIS conclusions do not consider these water rights. A water right claim is a statement by a property owner that a water right exists. In a general water right adjudication it is possible or likely that many or most of these claims will be issued certificates with priority over existing certificate water rights. In performing a current beneficial use assessment, there is no basis for excluding this information. The final EIS conclusions concerning potential impacts should consider the impact of the project on all water rights on or adjacent to the project Site (Township 22 north, Range 3 East, Sections 20, 21,22, 28,29,30,31,32).

Landau Associates

Comment L-5.012

13. The AESI (1998) report lists certificate water rights in a number of sections that do not appear to be plotted on DEIS map. For example, in Section 21. A. and L. Persinger have a certificate water right (214980) for multiple domestic and commercial use of 250 gallons per minute instantaneous quantity and 172 acre-ft/year total annual appropriation. This well appears to be the largest certificate groundwater water right in the vicinity of the project, yet the well is not identified in the DEIS well location map nor is the water right or water use discussed in the text. In our opinion, the DEIS needs to consider these uses and this readily available information prior to evaluating project impacts. The Ecology WRATS database lists water rights for numerous springs and streams in the project area. For the seven sections where well use was evaluated in the DEIS (Appendix A, Figure 9), 69 unnamed springs, streams or creeks are listed by Ecology along with one named spring (Cornwell spring in Section 31). Of these surface water bodies only Dockton springs and the Hake spring are discussed in the DEIS. Given the apparent ubiquitous presence of small streams and springs in the project area that were not considered in the DEIS, the DEIS statement that "no evidence of creeks or seasonal water bodies in the uplands or within the pit area" (pg. 4-6) and "the lack of creeks in the vicinity of the Site" (Appendix A, pg. 14) does not appear to be valid. Conclusions regarding the lack of an interflow zone and the lack of potential for

aquifer breach need to be reconsidered based on an understanding of the hydrogeologic processes that contribute to these springs and streams.

Landau Associates

Response

All wells that can be plotted to within one-quarter of a one-quarter section (40-acre parcel) have been plotted. The water right claim on the Glacier Northwest site is discussed further under the heading "Water Source" below.

Only a court can adjudicate (validate) any of the adjacent water rights, claims, certificates, or applications. However, the analysis done for the EIS indicates that none of the beneficial users would be deprived of groundwater.

For the FEIS, a current WRATS inventory was obtained and incorporated into the analysis. Data from the current WRATS does not affect any of the conclusions reached in the DEIS or FEIS. The WRATS database contains only general information on the location of the purported beneficial use of water. The analysis used in the preparation of the DEIS and the FEIS took into account the regional geologic conditions and the lack of credible flows of water to offsite springs. As discussed above, the site is in a bowl defined by lower permeability materials, which directs the flow of water within the principal aquifer toward the site.

The groundwater resource has been discussed in sufficient detail in the EIS to assess potential impacts for offsite beneficial users. Additional information that may be developed in the course of the Ecology study on offsite beneficial users would be factored into the final design of the project. Based on published geologic information supported by the site-specific subsurface explorations and the results of the Ecology study, there is no reason to believe the site directly feeds offsite springs or surface water courses. In addition, by preserving the amount of water that infiltrates and recharges the aquifer, adjacent wells that tap either the principal or deep aquifer would not be deprived of water.

The EIS Team performed reconnaissance visits to the site vicinity during the wet seasons of 1998/1999 and 1999/2000. The reconnaissance visits were performed during periods of dry weather to remove the influence of storm runoff from roads and other areas of compacted surface soils. No surface flows were noted in any of the drainage swales in the site vicinity. The closest upland surface water flows found were near the intersection of SW 248th Street and Dockton Road SW from a seepage zone at approximately elevation 180. No Surface water flows were present

in the drainage swales that pass beneath Dockton Road SW from Dockton Springs to the intersection of 75th Avenue SE and Dockton Road SW. No surface water flows were noted in the breaches of the bluff that allow access to Gold Beach and to Sand Shores. It is expected that further south and north of the site, where the top of the lower permeability pre-Vashon sediments rises, that the seepage zones from the principal aquifer would also rise.

There is no dispute that springs exist on Maury Island that were not discussed specifically in the EIS documents. However, the reconnaissance visits performed by the EIS Team indicate that the discussion of impacts and flows to offsite locations is sufficient to document the impacts of the proposed action.

The A. and L. Persinger water right in Section 21 is not specifically discussed in the text of the EIS documents. The study and analysis performed for the EIS has demonstrated that the water resource that exists will be preserved. There is no need to discuss each well in detail. The wells that were discussed in detail in the text of the EIS documents were discussed in detail due to the availability of well logs associated with those wells.

Evapotranspiration

Comment Clarify how removal of vegetation is important to recharge, particularly as the site is identified as a discharge area.
Vashon-Maury Island Community Council

Comment C-12.010 (part 2 of 2) Removal of vegetation will also increase evaporation rates and represent a loss of filtration into the aquifer.
St. George, Brian

Comment I-1.012 project impacts … severe alteration of evapotranspiration.
Shipley, Frank

Response Removal of the vegetation would decrease the evaporation/ transpiration rate and make more water available for recharge.

Water Use

Amount of Water

Comment C-12.010 (part 2 of 2) Why would much less water (than the 0.8% reduction at maximum use) be required on an annual basis if this impact assessment is based on maximum extraction?

St. George, Brian

Response Water for dust control would not be needed every day. Natural rainfall would provide dust control on many days and the mine would not operate 365 days per year. Hence, the actual amount of water needed for dust control would be less than 10,000 gallons per day. Nevertheless, the impact analysis in the FEIS assumes water usage of 10,000 gallons per day.

Comment O-1.189 p. 4-13. This section states that water use could be up to 10,000 gallons of water during dry periods to control dust. This section fails to indicate whether this is per day or per "dry period", but it is another example of Jones & Stokes inability to write a clear DEIS. Elsewhere it states that during dry conditions the operation would utilize a water-spray truck to wet down exposed materials and use about 10,000 gallons per day (p. 3-9). However, the DEIS elsewhere lists the following separate water depends: manual washing system (Table S-2), dust control by manual spraying (Table S-2), road washing (Table S-2), and irrigation of seedlings (Table S-4). What is the total annual quantities of water that would be use annually for each of these activities?

Ortman, David

Comment O-1.199 Aquifer recharge/Proposed Action: It states that the project would increase water consumption on the Island by 0.8 percent. The DEIS notes that water may be needed for the following: manual washing system (Table S-2), dust control by manual spraying (Table S-2), road washing (Table S-2), irrigation of seedlings (Table S-4) and misting of the conveyor belt system (Appendix A, p. 26). Please provide an estimate of the gallons of water that would be used by each of these activities annually.

Ortman, David

Comment I-17.022 (regarding dust control measures) Washing the access road … what is the source of water for this proposal, how much water would it require, and how would the water be transported to the site?

Putnam, Joshua

Comment O-1.248

What is the estimated amount of water that would be used annually to irrigate madrone seedlings?

Ortman, David

Comment G-5.023

23. Will the fill be watered to attempt to control particulate and, if so, how much water will be used annually?

Citizens Against SeaTac Expansion

Comment O-1.216

4.5 p. 4-18. It states that use of water for dust control would be an additive water use on the island. As noted above, there are multiple proposed uses for water including manual washing system (Table S-2), dust control by manual spraying (Table S-2), road washing (Table S-2), and irrigation of seedlings (Table 54). The DEIS must describe the cumulative impacts from all proposed use of water, not just dust control.

Ortman, David

Comment

At a minimum, the FEIS must include a study of the volume of water it will take Lone Star to adequately control arsenic-laden dust, soil remediation and all other mining activities.

Means, Shelley

Response

Water usage needs have been clarified in the FEIS.

Water use at the site would be limited to wetting of surface materials for dust control, as needed. At maximum mining rates during dry weather, up to 10,000 gallons of water per day would be used, based on the Applicant's estimates. This is the maximum daily water usage rate assumed for the EIS (see Section 3.4.2 of the FEIS). In the FEIS, it is assumed that water would be obtained from off-island sources, and trucked onto the island.

Water would not be required for a wheel washing system, for road washing, or for madrone irrigation. King County has determined that wheel washing and road washing would not be needed to control dust at the site (FEIS, Section 3.4), since no significant adverse impacts would occur without them. Under SEPA, mitigation measures can be required only for adverse impacts, and under existing policy or code (WAC 197-11-660). Wetting of surface soils would be used, as proposed by the Applicant and as discussed in the DEIS, to control airborne dust and to prevent visible dust plumes (FEIS, Section 3.4.2). Irrigation of madrone in reclamation areas would not be required, since madrone is drought-tolerant and would be expected to regenerate without artificial irrigation.

Thus, total water needs would be a maximum of 10,000 gallons per day, and less water or none would be needed during periods of wet weather or when the mine was inactive.

Comment

4.13.5. What are the "offsite sources" of water? What is the confidence in the estimate of 10,000 gallons per day? Is this for a worst case (75-year drought) scenario?

Kuperberg, J. Michael, Ph.D.

Response

It would be the responsibility of the Applicant to obtain water required for dust control. The estimate of 10,000 gallons per day was provided by the Applicant, and would be the amount needed to wet surface materials within active mine areas when they are dry.

Source of Water

Comment I-12.001

Where will the 10,000 gallons of water per day that may be used in dry weather come from?

Chasan, Daniel Jack

Comment

Section entitled "Minimal effect on Island water resources from using water for dust control" [Table S-3]. Since dust control is a significant issue for neighbors, what will happen if the predicted volume of water is not sufficient to maintain dust control? What water sources would constitute the "variety" discussed here?

Kuperberg, J. Michael, Ph.D.

Response

Based on comments received, the FEIS has been revised with respect to water sources. The Applicant did not specify a source of water for dust control, but it would be the Applicant's responsibility to obtain the water needed for dust control. Given the sensitivity of the water supplies on Maury Island, it is likely that it would be difficult or impossible to obtain water from on-island suppliers. For the purposes of the EIS, it is assumed that water would be obtained from off-island sources and trucked to the site. According to comments received from the Department of Ecology, water would need to be obtained from a municipal water supply.

Glacier Northwest does have a water right claim onsite, and could choose to exercise that claim to obtain water for dust control (see further comments and responses below under heading "Glacier Northwest Water Right Claim").

Comment A cost/benefit analysis of what County will earn in revenues from the mine vs. the costs of a pipeline for water should be included in the analysis of the EIS.

Nelson, Sharon K.

Comment I would request that proponent provide an engineering study and cost analysis regarding a water pipeline and identify a supplier for water for that pipeline to Maury Island.

Nelson, Sharon K.

Response Water for dust control would be trucked onto the site. No pipeline is proposed.

Comment I-9.009 … EIS fails to fully evaluate and address … the proposed increased use of water for dust control. … the County's solution of requiring that Lone Star obtain the water from different purveyors fails to recognize that this is one sole source aquifer.

Mackey, Cyndy

Response It would be the responsibility of the Applicant to obtain the needed water. No specific source has been proposed, and King County cannot force or direct any purveyor to sell water to Glacier Northwest. The comments from Ecology (above) indicate that water would need to be obtained from a municipal water supply. For purposes of the EIS, King County assumes that the Applicant would need to obtain water from an off-island source, although the Applicant could choose to exercise its existing water right claim (see further comments and responses below under heading "Glacier Northwest Water Right Claim").

Comment I-1.019 project impacts … use of as much water for dust control (presumably groundwater) as would support almost 100 island residents (per capita based on proposed use of 0.8 percent of island's water page 4-13).

Shipley, Frank

Comment The use of 10,000 gallons a day during the dry months will strain the water supply system, and represents 91.7 times the average daily use for the individual citizen on Vashon-Maury Island. This is a significant increase and should be discussed.

Vashon-Maury Island Community Council

Response

The impacts of the proposed water use are discussed in Section 4.3.1.1. King County assumes that the Applicant would need to truck water to the site from off-island, municipal water sources. The application of off-island water would result in increased recharge to the aquifer at the site, and thus would have no adverse impact.

In the event that the Applicant were able to obtain water from on-island suppliers, then the 10,000 gallon per day usage could increase daily consumption on Maury-Vashon Island by 0.8 percent, as discussed in Section 4.3.1.1. This level of consumption would not affect availability to other water users on Maury-Vashon Island, and is therefore not a significant impact (see Section 4.4.1). Should supplies become constrained, suppliers would certainly give priority to residential users, and Glacier Northwest would have to identify an alternative source. Moreover, the potential net increase in water consumption would be offset by increased recharge to the aquifer due to removal of vegetation (Section 4.3.1.1 of the FEIS), and by infiltration of the water applied for dust control.

Glacier Northwest could choose to exercise its existing water right claim to obtain water for dust control (see further comments and responses below under heading "Glacier Northwest Water Right Claim").

Glacier Northwest Water Right Claim

Comment

Note that there is apparently no mention in the DEIS of a water right claim submitted by Lone Star for spring flow apparently on the project site itself. The DEIS plots wells near the project site on a map (Appendix A, Figure 9). This map is incomplete in that it does not include all wells that are on record with Ecology.

Landau Associates

Comment A-3.002

(repeated in Permits) Lone Star has a water right claim from a spring on the proposed mine site. If consumptive use of water from the spring for the proposed expanded mine operation is in excess of water quantities historically used, the mine will require a Water Right Permit from the Department of Ecology. If water is imported from off-site it must be purchased from a municipal water system because of place of use restrictions on other than municipal systems.

Ecology

Response

FEIS Section 4.3.1.1 has been revised in response to these comments regarding Glacier Northwest's existing water right claim. Glacier Northwest could choose to exercise its existing water right claim to obtain water for dust control.

The groundwater balance assessment in Section 4.3.1.1 of the FEIS shows that the existing and proposed mine would temporarily increase the amount of water available for recharge to the aquifer due to removal of vegetation. This additional recharge would provide adequate capacity to accommodate this consumptive water use onsite. In addition, except for water lost to evaporation, the water applied for dust control would infiltrate and contribute to recharge of the aquifer. Thus there would be no significant impact if that water right were exercised.

4.3.2 Would mining affect groundwater quality?

Comment

The DEIS does not adequately address the risks of contamination to the Maury Island aquifer.

Derrer, David

Response

Potential contamination sources are identified and evaluated in Chapters 4 and 10. Soils contaminated with arsenic, lead, and cadmium would be contained in an impermeable containment cell. The issue of contamination from arsenic, lead, and cadmium present in surface soils is addressed in Chapter 10. The issue of fuels and lubricants from mine machinery would be addressed thorough the use of Best Management Practices and lawful cleanups that would be required in the event a spill or release did occur. King County could require that fueling occur in designated areas with spill containment facilities (see Section 4.4.3.8).

Comment

3 (of 22). Chapter 4, Section 4.4.1 discusses the retention/infiltration pond. Section 4.3.2.1 discusses how water moves from the site toward the Sound. Further, the site has been defined as a discharge zone rather than a recharge zone. Please discuss how the mining will affect water temperature, both for the aquifer and for the Sound, due to the discharge from the site. Please discuss what type of warming would occur.

Nelson, Sharon K.

Response

Water temperature was not identified as a likely adverse impact during scoping, and is not likely to be significantly affected by the proposed mining activity. Groundwater flows from the site toward Puget Sound. No changes in water temperature are expected in Puget Sound.

Onsite Fuel Handling

Comment G-3.011

11. Section 4 3 2 This section fails to clarify the question of whether or not fleet fueling is legal in King County—a question that several King County staff we contacted could not answer.

People for Puget Sound

Comment I-7.035

What about the scenario of a fuel truck tipping over on a temporary dirt mining road? … The sand will not act as an effective filter for such a spill. … how will the site be protected for any future use?

Meyer, Michael

Comment

4.14.5. Fueling procedures should be stringent, especially considering the minimal distance to groundwater through porous media. How would such procedures be enforced? A spill could be catastrophic.

Kuperberg, J. Michael, Ph.D.

Comment C-2.005

Vehicle fueling and equipment maintenance areas should be lined and covered concrete structures.

Ernst, William

Response

All fuel transfer would be done in accordance with local, state, and federal laws and regulations. Any potential spills that occurred during fuel transfer would be cleaned up in accordance with local, state, and federal laws and regulations. Best Management Practices contained in the Storm Water Manual for Washington State would be required at this site as with any other similar site in Washington State.

Additional impacts and mitigation measures for potential fuel spillage are discussed in Section 4.4.3.7 and 4.4.3.8.

Loss of Natural Filtering

Comment I-10.005

… because of ground water impacts and arsenic issues, the depth of any pit should be limited with a much greater safety factor then currently proposed

Adams, Charles

Response

The extent of mining would be limited by the documented static water levels and the projected localized mounding that would occur beneath the infiltration facilities. The issue of arsenic would be resolved through a voluntary cleanup in accordance with Washington State laws (see Chapter 10).

Comment I-11.003

Lone Star proposed to dig within 10-15 feet aquifer, creating the very real possibility of water supply disruption or contamination to the single-source aquifer.

Elizabeth Parrish/John Rees

Comment I-21.023

… I'm very concerned about the excavation within 15' of our aquifer. How was this measure decided? Shouldn't there be as much material as possible above the aquifer for filtration and possible mitigation?

Baker, Alby

Comment I-9.006

… EIS fails to fully evaluate and address the consequences of removing nature's materials that currently filter and slow recharge.

Mackey, Cyndy

Comment I-21.025

Does quicker recharge flow to our aquifer (mined within 15 feet) allow for adequate filtration? Doesn't slower filtration act as a kind of reservoir?

Baker, Alby

Comment

Table S3. Section entitled "No effects on local drinking water supply related to aquifer recharge". It should be noted that not only would the mining operation "reduce the time it takes water to reach the water table", but it would remove the majority of the material that currently filters water prior to reaching the water table. The effects of this loss of filtration capacity have not been addressed. If (3) is correct, why is there further discussion of water table recharge? Is an increase in recharge (5), especially through a minimal filtration system an advantage?

Kuperberg, J. Michael, Ph.D.

Comment Section entitled "No significant effect on groundwater quality". What is the current depth of the filtering layer that is proposed for reduction to 15 feet? How is it known that 15 feet "would filter out sediments"?

Kuperberg, J. Michael, Ph.D.

Comment 4.9.2. It is the slow travel of water through the sand and gravel that filters it. Removal of 300 feet of "filter" will affect this process, probably not positively.

Kuperberg, J. Michael, Ph.D.

Comment Where is the data to support the claim that a 15 foot sand/gravel level as effective to filter sediment?

St. George, Brian

Comment I-1.017 project impacts ... reduction in natural filtration of recharge by reducing aquifer overburden to 15 feet.

Shipley, Frank

Comment G-2.013 (#13) 4. 3. 3. We do not believe the 15-foot buffer between the bottom of the pit and the aquifer is adequate. More information should be required to make a judgment on the safest depths in relationship to the principle aquifer. No information has been provided as to the justification for this depth. How was this determined? Who will be monitoring the ground water and what is the methodology?

Washington Environmental Council

Comment C-7.001 A much larger buffer zone between the maximum mining depth and the aquifer are needed to reduce drinking water risk.

Brown, A.

Comment C-12.011 Where are the data to support the claim that a 15-foot sand/gravel level is effective to filter sediment?

St. George, Brian

Comment C-2.014 The applicant has minimized perimeter buffers and the protective separation to the top of the aquifer to an unacceptable extent. In the absence of scientific data or other technical justification clearly demonstrating their adequacy, these buffers and separation gaps must be enlarged to provide essential safeguards and physical measures to protect the environment, Maury Island's critical aquifer, the community, and individual residents.

Ernst, William

Comment I-4.002 Expanded mining would endanger the only source of potable water on Maury Island by putting equipment and toxic compounds within 15 feet of the aquifer and eliminating the existing filtering

and protective layers on the site.

Gylland, Barbara and Fred

Comment C-2.004

The 15-foot separation proposed as a measure of protection between the bottom of the mine floor and the projected top of the aquifer is not adequate.

Ernst, William

Comment G-5.003

3. A larger buffer zone between the maximum mining depth and the Maury Island aquifer is needed to reduce the risk to drinking water.

Citizens Against SeaTac Expansion

Comment

4.15.2 The use of stormwater management criteria to determine final grade elevation are curious. Is this aquifer considered to be a potential source of drinking water? If so, it should be regulated accordingly.

Kuperberg, J. Michael, Ph.D.

Response

The appropriate technical and regulatory standards for depth of surface materials above an aquifer are given in the Surface Water Design Manual for King County. The Surface Water Manual requires a 2-foot depth of sand filtration for certain surface water treatment facilities to clean storm runoff from paved areas. The proposed 15-foot buffer would exceed that thickness. In addition, the sand present at the lower elevations of the mine generally conforms to the specifications contained in Section 6.5 of the King County Surface Water Design Manual. These regulations apply to areas where the underlying aquifer serves as a domestic water supply, and are therefore deemed by King County to be adequate to protect groundwater resources.

Sand filters are commonly used by large municipal water systems that rely upon surface water for drinking water sources. Hence, the minimum 15-foot sand buffer that would be left would be adequate to filter the water of any constituents that would normally be expected in surface runoff from a mine and from the forest that would be planted during site reclamation activities.

No contamination source on the site would dictate the need for filtration requirements beyond those of the King County Surface Water Design Manual. Soils contaminated with arsenic, lead, and cadmium would be contained in an impermeable containment cell. The issue of contamination from arsenic, lead, and cadmium present in surface soils is addressed in Chapter 10. The issue of fuels and lubricants from mine machinery would be addressed thorough the use of Best Management Practices and lawful

cleanups that would be required in the event a spill or release did occur. King County could require that fueling occur in designated areas with spill containment facilities (see Section 4.4.3.8).

Some water storage occurs in the thickness of the sand that currently exists on the site, and removal of most of this material would alter the recharge regime at the site (Section 4.3.1.1). As discussed in Section 4.4, the infiltration facilities could be designed to allow incremental infiltration.

Comment I-1.022

… 15 feet of till above the water table would "effectively filter sediments or other contaminants" is not necessarily true—viruses, for example could enter the aquifer.

Shipley, Frank

Response

Viruses are not an anticipated potential contaminant.

Comment I-21.028

(repeated) Appendix A 22 "compaction and placement of till soils in the floor of the pit could increase water run-off into Puget sound, rather than recharge of the aquifer". What does this ultimately mean for the quantity and quality of filtration given a 15' buffer.

Baker, Alby

Response

Mining with no controls on the placement of compacted soils could increase runoff to Puget Sound. In addition, the proposed drainage plan would result in increased chance for runoff of surface water into Puget Sound, as discussed in Section 4.3.6, and would thereby reduce recharge to the aquifer (Section 4.3.1.1). Geo/Hydro Mitigation 1 and 2 (Sections 4.4.3.2 and 4.4.3.4) would eliminate that impact. These measures include a final mine design that controls and concentrates infiltration in designated areas chosen to promote even and steady infiltration.

Comment I-6.012

What are the hydrogeologic, and arsenic fate and mobility calculations used to substantiate the adequacy and protectiveness of a 15-foot buffer zone? (see also 10.4.1)

Gorski, Alan

Response

The arsenic issue is independent of the 15-foot buffer zone. The soils impacted by arsenic would be segregated and placed in a

lined facility to eliminate the potential pathway linking the arsenic and the groundwater. Potential impacts related to arsenic are addressed in Chapter 10.

Comment O-1.209

Groundwater Quality/Proposed Action: It states that a relatively small amount of machinery and fuel would be required and that at least 15 feet of sand/gravel would be maintained between the floor of the mine and the water table. What would be the primary constituents of this 15-foot layer? Mostly sand? Half sand/half gravel? Mostly gravel? What is the significance of the depth of the 15-foot layer?

Ortman, David

Response

The layer is expected to consist primarily of fine to medium sands. In some areas, particularly where the final buffer thickness exceeds 15 feet to accommodate mounding, some of the overlying sands and gravels could also be included as part of the final buffer.

The 15-foot buffer is intended to allow for some seasonal rises in groundwater elevations without having the groundwater surface and create surface water flows. In addition, as discussed earlier, the buffer layer acts as a filter, much like the sand filters used in some storm water management facilities or in municipal water supplies obtained from surface water sources.

Comment

During the excavation, Lone Star proposes to dig to within FIFTEEN feet of the sole-source aquifer of Vashon/Maury Island. This seems absurd - the potential of contaminating the drinking water for 14,000 people is too great. Is King County, on behalf of all of the taxpayers, willing to take the risk? If the damage is done, King County will have to supply everyone on the island a means of obtaining safe drinking water for the rest of time — a very expensive proposition. While the onus will be on Lone Star, you can bet the first thing they would do is declare bankruptcy to protect themselves, and then the taxpayers will be left holding the bill — again. This is a tax-bill I would refuse to pay, as well I am sure most of the others.

Jonathan Parrott

Response

Comment noted. King County has determined that the proposed mining activity would not pose a significant risk of contamination to the aquifer. The Applicant may be required to post financial guarantees under KCC 16.82.170.

Beneficial Uses

Comment L-5.012

12. BENEFICIAL USE CHARACTERIZATION. To address the primary concern of whether the project would affect the amount of drinking water to residents, it is essential to understand what the current uses are and predict what future uses are likely to be. Also, an accurate assessment of current uses, such as springs and streams, provides valuable information on the project area hydrogeology. The DEIS evaluation of current beneficial water uses in the immediate project area is superficial and incomplete. Numerous documented water resource uses are not mentioned. These include water rights on unnamed springs and streams in the direct project vicinity. The presence of these surface water bodies represent potentially valuable information relating to the occurrence and importance of perched aquifers, groundwater interflow and site hydrogeology.

Landau Associates

Response

The county team made two reconnaissance visits of the site vicinity during the wet season of 1998/1999 and 1999/2000. No surface water flows were noted in the breaches that provide access through the bluff to either the Gold Beach or Sandy Shores areas. Springs in these two areas are visible at beach level, just as they are at the subject site. The geologic information shows clearly that lower permeability materials are present at higher elevations both north and south of the site. Hence the base of the primary aquifer is located at higher elevation and associated seepage zones north and south of the site are at higher elevations as well. To pursue the incomplete information available at Ecology would not add any certainty to the analysis.

Comment L-5.012

13. The DEIS also does not provide a discussion of likely future groundwater uses. Without an accurate and complete assessment of current beneficial uses on and adjacent to the project area, conclusions regarding the hydrogeologic assessment, potential impacts and mitigation are incomplete. The final EIS should base its conclusions on an understanding of these uses.

Landau Associates

Response

To speculate on future additional uses is beyond the scope of SEPA. The analysis used is focused on preserving the existing groundwater resource.

4.3.3 Would the mining activity breach an aquifer or otherwise impact adjacent groundwater wells being used by local residents?

Comment G-2.010

10. 4.2.4.4. It is stated that the separation between the primary aquifer and the deep aquifer on the project site is not distinct. Further, the DEIS states that at the Lone Star site the aquifer can be thought of as "one continuous system". In the next paragraph it states "the materials mined are located above the primary aquifer". If the primary aquifer and deep water aquifer are the same on the Lone Star site then this site can be considered a recharge area for the deep aquifer which provides water for other locations on Maury Island. If this is true then the potential impact to the water supply in the case of a breach has not been mitigated. It is stated in 4.2.4.7 that some of the water beneath the site "likely" contributes to the deeper aquifers in the immediate vicinity. This information is not substantiated with scientific data. Further clarification is needed in order to determine the potential impacts to the aquifers that would affect the entire island.

Washington Environmental Council

Comment

At the least I am demanding that DDES follow tenet 1202 of the Comprehensive Plan, which requires all land use policies respect the overriding importance of single-source aquifers. To mine within 15 ft. of the aquifer on this island is unconscionable, for there is no alternative for us if Lonestar breaches our aquifer.

Powell, Cynthia S.; Michael G. Zecher

Response

There would be no impacts to groundwater resulting from a breach in the aquifer because mining would not breach the aquifer. In order to breach an aquifer, excavations would need to extend to beneath static water levels. No excavations are planned or would be allowed that would expose the principal or deep aquifer. The proposed action calls for maintaining a 15-foot buffer between the mined surface and the top of the water table. The static water levels on the site are well documented; further verification of static water levels would be done prior to final mine design and development and throughout the life of the mine. The groundwater that occurs above the till layer found on portions of the site is a seasonal water body called interflow. The interflow is seasonal in nature and would not be useful to provide reliable water for irrigation in the dry season or for a drinking water source. In addition, no evidence that the interflow leaves the site to feed offsite resources has been identified.

The classic aquitards present in the simplified and generalized models of the Vashon/Maury Island aquifers have not been specifically identified on the site. In fact, this site sits in a trough where existing maps show the advance sands extend beneath sea level. A similar situation has been mapped elsewhere only at the site extending through Dockton, reaching up through Burton, and ending near Point Heyer. Hence, it has been assumed that the principal aquitards, either the Quaternary Transitional beds or the Olympia beds, are not present beneath the project site. This finding requires a conservative approach to the analysis that assumes hydraulic continuity between aquifers. This conservative approach is the one used in the EIS. To minimize impacts to the infiltration regime and minimize groundwater mounding, the mine would need to be designed to maintain infiltration of the precipitation that falls on the site. Infiltration facilities would need to be dispersed through the interior of the site and not placed along the beach. Mitigation measures to preserve the existing infiltration pattern are outlined in Section 4.4.3.2.

Comment I-21.027

EIS 4.8. "It appears that the separation between the primary and deep aquifers is not so distinct". … What are the implications here? Could Lone Star then actually breach both aquifers?
Baker, Alby

Comment C-8.092

4 3 3. #92 Page 4-15. discusses the breaching of an aquifer which has occurred elsewhere. Please provide additional discussion why, when perched aquifers have been identified on the property, these perched aquifers would not be breached by the mining activity. Please discuss whether inadequate site information, or misinterpretation of hydrogeologic data caused the aquifer breach in Monroe. Please provide more discussion of how the conclusion on page 4-16 that "these isolated pockets do not contain sufficient water to be considered an aquifer in themselves" was reached. What were the size of the perched aquifers, how were they measured, and based on wells solely on the perimeter of the property, how can this absolute determination be made?
Vashon-Maury Island Community Council

Response

A detailed specific discussion of the Monroe gravel pit issue is not relevant to this study since the geologic setting is different. The conclusion regarding the pockets of perched groundwater is based on data obtained from onsite borings, wells, and exploration pits; these perched groundwater pockets are discussed more fully in Section 4.2.4.3 of the FEIS and in Section 4.2.4.3 of this Volume.

Comment I-14.006 What is the probability of breaching the water table? It is certainly not zero.

Smith, Eugene A.

Comment I-1.023 … applicant concludes there is "no potential breach of the aquifer" but actual risk analysis, if it had been conducted, would assign a positive non-zero risk.

Shipley, Frank

Comment I-3.003 … DEIS does not adequately address: the possible penetration and pollution of the island's sole-source aquifer.

Pearce, Judith Wood

Comment I-1.018 project impacts … increased risk of aquifer breach and contamination

Shipley, Frank

Comment I-8.001 Table S-3. "No potential to breach an aquifer because materials …". Of course there is potential to breach when you mine to within 15 feet!

Kritzman, Ellen B.

Response The mine would not extend into the primary aquifer. The top of the groundwater has been well defined by existing monitoring wells and measurements. Additional monitoring would occur as part of the final mine design, and throughout the life of the project. The mine operations would have a minimum 15-foot buffer between the highest anticipated static water level and the floor of the mine. Hence the primary aquifer and deeper water bodies would not be breached or directly exposed by the mine.

The water table is well defined by the existing monitoring wells. Local small seeps may be encountered in the upper portion of the pit walls as discussed in the FEIS. However, the current requirement is that the facility maintain a minimum of 15 feet of undisturbed materials between the floor of the mine and the highest expected groundwater level. This groundwater level would include the local mounding that would occur beneath the proposed infiltration facilities.

Comment I-13.003 Can an earthquake open up 15 feet of earth exposing an aquifer? … 20 feet? … 30 feet? 50 feet? What mitigation measures are in place to prevent earthquake damage? How can Lone Star repair or compensate for irreparable damage to our water?

Kirkland, Michael

Response

King County would require that the final mine design be stable under the range of anticipated earthquakes.

Comment I-6.013

What agency will be watching to guarantee that there is no breach of the aquifer?

Gorski, Alan

Response

King County and the Washington State Department of Natural Resources would monitor mine activities.

Comment

Section entitled "No potential to breach an aquifer" [Table S-3]. This section implies that final grade will be adjusted (presumably either up or down) to maintain a 15 foot layer above the water table. However, this adjustment would cease when reclamation begins. Is there any potential for the water table to rise after reclamation begins, resulting in a final grade with less than 15 feet of filtering material above the water table? How would such a situation be addressed (i.e., if the 15 foot layer is necessary, what will happen if it is not maintained?).

Kuperberg, J. Michael, Ph.D.

Response

There is no reason to expect the water table to rise more than 15 feet; such an event is speculative, and beyond the scope of an EIS.

4.3.4 New Section: Would the proposed mining cause saltwater intrusion to the freshwater aquifer?

Comment L-5.010

10. SEA WATER INTRUSION IN THE DEEP AQUIFER. The deep aquifer is described by Carr (1983) as consisting of sand units sandwiched within a silt or clay deposit. The aquifer exhibits variations with depth, thickness and character. The deep aquifer is important in that many, if not most, of the water supply wells on Maury Island draw water from this zone. The aquifer occurs below sea level and potentially receives minimal amounts of recharge. Consequently, the aquifer is susceptible to seawater intrusion. The DEIS characterization of the deep aquifer is limited due to a lack of information. The DEIS suggests that the amount of recharge to the deep aquifer is restricted by "the permeability of

the aquitard and other intervening Strata" (Appendix A, pg. 9). However, the deep aquifer was not encountered in any onsite borings. In our opinion, additional characterization of the deep aquifer is necessary to evaluate the impacts of the project on this water resource. The susceptibility of the deep aquifer to changes in recharge is not addressed in the DEIS. Using estimates from Carr (1983), the deep aquifer is recharged at a total rate of about 250 gallons per minute. Based on this assessment, the aquifer is probably already being over pumped. Consequently any impact of the project that results in reduced recharge to the deep aquifer will directly impact the ability of this aquifer to serve as a viable water resource. The DEIS should contain a detailed analysis of recharge to the deep aquifer before and after mining and either use Carr's assessment of recharge or independently develop a defensible assessment.

Landau Associates

Comment L-5-010 11

A primary concern with the DEIS characterization is the lack of discussion of the potential for seawater intrusion. Seawater intrusion can occur when coastal aquifer water levels change due to pumping or modifications in recharge patterns. A decline of 1 foot in the freshwater aquifer at the seawater interface can cause the interface to rise 40 feet (Freeze and Cherry 1979). If the project results in lower average water levels in the principal aquifer, recharge rates to the deep aquifer will also be affected thereby resulting in some degree of seawater intrusion. The DEIS indicates that the site "is near where fresh and saltwater bodies meet" (pg. 4-10) but does not discuss the risk of saltwater intrusion due to potential impacts of the project. An evaluation of this risk should be considered in the EIS.

Landau Associates

Comment I-9.011

EIS fails to fully evaluate and address … the possibility of creating a pathway for saltwater intrusion is ignored by the EIS.

Mackey, Cyndy

Comment I-2.002

… sole source aquifer is 50 ft below the surface but when mining is complete would be ... 15 ft below surface probably causing the destruction of the aquifer to salt infiltration.

Clark, Rose

Response

In response to comments and public concerns, a new section (Section 4.3.4) has been added to the FEIS to assess potential seawater intrusion. During and following mining, the amount of water available to recharge the deep aquifer would increase, although variability in recharge rates would increase (Section 4.3.1). The mitigation measures discussed in

Section 4.4.3 would reduce these changes and mitigate the long-term changes in the recharge pattern. For saltwater intrusion to occur, the groundwater level must be lowered. As shown in the groundwater balance calculations, the existing mine has significantly increased the amount of water that infiltrates the site through the removal of at least 40 acres of trees. Throughout the life of the borrow pit operation, it is anticipated that up to 60 or 70 acres would be devoid of vegetation. Thus, there would be increased recharge to the aquifer through the life of the pit. Hence the water level would be higher than it would have been in the unmined state and the saltwater interface would likely move out towards the Sound from its premining location. At the cessation of mining, the saltwater interface would return closer to its natural site.

4.3.5 New Section: Would the proposed mining activity create slope stability problems?

Comment I-4.003

(repeated) Grading of the site will have deleterious consequences on the hydrogeology of the area, promoting erosion, making this residential portion of the Island more susceptible to landslide, and interfering with the recharge of the aquifer.

Gylland, Barbara and Fred

Response

Erosion would be controlled using Best Management Practices in accordance with King County Regulations. The potential for landsliding would be decreased following mine closure due to reducing the height of the bluffs and reducing the potential for wet season seepage along the top of the bluffs.

Comment I-2.005

What about the loss of deep root systems protecting the slopes from slides?

Clark, Rose

Comment I-2.006

Will the property that is higher slide into the Sound?

Clark, Rose

Comment I-1.037

Impacts related to a major subduction zone earthquake are not mentioned.

Shipley, Frank

Response

Elements of the site development that are susceptible to seismic events would be designed in accordance with County requirements and current engineering practices. Site reclamation would include measures to stabilize slopes.

Comment I-21.030

(repeated in 9.3.1) Is there some magic in the SMA wording that will prevent erosion in the mined areas adjacent to the "erosion hazard area"?

Baker, Alby

Comment I-21.029

… is bluff erosion of the 200' buffer somehow not expected to occur? What will the site be like 25 or 100 years from now?

Baker, Alby

Response

The final design of the mine, including the arsenic-impacted soils isolation berm, would include slope stability analysis. This analysis would include a seismic analysis.

The bluffs above Puget Sound would remain unprotected from wave erosion. Erosion of the toe of the slopes would result in continued sloughing of site soils from the existing bluffs. However, removal of materials from above and behind the bluff would reduce the potential for deeper sloughs through a reduction in the overall height of the bluff. Bluff retreat through wave erosion is a natural occurrence along Puget Sound and has been occurring since the retreat of the glaciers from this area. The proposed action would not increase the erosion rate of the bluff by wave erosion.

Comment

The issue of seismic activity has to be considered in all this. Scientists are in disagreement if the fault of Point Robinson is indeed part of the larger Seattle fault or a separate fault. What they do know, is that the area is highly seismic and the potential for a catastrophic earthquake increases with each passing day. The potential disaster could be even worse as this mining venture proceeds. First, digging so close to the aquifer is cause for extreme alarm, but coupled with a potential earthquake, the aquifer could been damaged beyond use. Second, the mention of slides/erosion along the bluffs is well known. Lone Star seems to think that they will remedy this situation. The site is in a highly sensitive area for slides/erosion. It must be remembered that our beaches must be fed by sediments to be maintained. The balance is most fragile. Lone Star has the capability of destroying the fragile balance of the

longshore transport of sediments along the beach.
Rossi, Michael & Marlene

Response

No seismic threat to the aquifer is foreseen. The soils that comprise the aquifer consist of a dense sand that would not be susceptible to liquifaction during seismic events. None of the proposed plans is intended to stabilize the existing natural slope erosion that occurs along the eastern side of the site. There would be a decrease in the amount of erosion that could occur on the bluff as a result of the mining operation due to a reduction in the height of the bluffs. No bulkheads are proposed to reduce wave cut erosion from the toe of the bluff. The existing dock would have less impact on the longshore transport of sediment than the concrete bulkheads that have been built on adjacent parcels of land.

4.3.6 New Section: Would proposed mining cause surface water runoff to flow off the site?

General

Comment I-9.007

EIS fails to fully evaluate and address … reduction in recharge quantity due to increased runoff in to Puget Sound.
Mackey, Cyndy

Response

Section 4.3.6 has been added to the FEIS to discuss potential impacts related to surface runoff. In addition, additional information on the impacts to groundwater recharge has been added to Section 4.3.1.1 of the FEIS. Additional mitigation measures are discussed in Section 4.4.

Comment I-3.005

DEIS does not adequately address: the surface/stormwater runoff issues.
Pearce, Judith Wood

Comment I-21.024

The EIS refers to King County storm water design manual. … Is this a storm water situation-so close to our aquifer?
Baker, Alby

Response

The Stormwater Pollution Control Manual describes pollution prevention practices for existing activities in unincorporated King

County. The King County Surface Water Design Manual applies to the design of surface water management facilities, including infiltration facilities, for new development or grading projects that require King County permits. The Surface Water Design Manual provides consistent requirements throughout the county and for special areas, and covers both water quality and water quantity. The standards in the Surface Water Design Manual can be strengthened if design-level studies and county review indicate that a higher level of control would be needed.

Comment I-9.005

EIS fails to fully evaluate and address … the potential for increases in turbidity.

Mackey, Cyndy

Comment I-9.014

(repeated) Turbidity will … increase during mining activity, particularly due to changes in surface water run-off.

Mackey, Cyndy

Response

Turbidity of surface runoff would be controlled in accordance with existing county, state, and federal requirements. The control of turbidity of surface runoff is a common element of storm water management plans and would be incorporated into the final site development plans.

Retention Pond Overflow

Comment O-1.192

Please revise this statement to clarify that during 25 year storm events, the retention/infiltration pond would overflow allowing runoff to flow directly into Puget Sound.

Ortman, David

Comment O-1.213

Groundwater Quality/Mitigation: It states that the retention/ infiltration pond would be sized for a 25-year, 24-hour storm event. Why is the pond sized in such a way that it is likely to overwhelmed on a regular basis? Why isn't the pond sized for at least a 100-year storm event?

Ortman, David

Comment O-1.284

Turbidity/Proposed Action: Please list overflow from the retention/infiltration pond from storm events greater than 25 years as a significant impact.

Ortman, David

Comment O-1.203

It states that the pond would only be sized for a 25-year, 24-hour storm event. Why is such a small pond proposed? What happens when storm events exceed the pond size?

Ortman, David

Comment

Why are standards for a "25-year, 24-hour storm" being applied to a project that may last 50 to 75 years? Does this not predict that, by definition, the site stormwater management system will be overwhelmed during its lifetime?

Kuperberg, J. Michael, Ph.D.

Response

The FEIS has been revised to more clearly describe impacts and mitigation of the proposed retention/infiltration pond. Impacts of reduced groundwater recharge are discussed in Section 4.3.1.1, and impacts of surface water overflow are discussed in Section 4.3.6 and 4.4.3.1. Mitigation measures are described in Section 4.4.3.2.

As proposed, infiltration ponds in the floor of the mine could overflow during storm events exceeding the 25-year storm. Mitigation measures described in Section 4.4.3 would replace the single pond with a multiple-point infiltration system that would more closely mimic existing conditions. The intent of mitigation would be to infiltrate 100 percent of the surface runoff generated from the mine into the aquifer, based on a 100-year storm.

Design of infiltration facilities is standard practice at mining and construction sites, is technically feasible, and would effectively mitigate the identified impacts.

Comment O-1.218

Groundwater Quality/Mitigation: It states that a retention/ infiltration pond would be constructed at the bottom of the mine site. However, from looking at Figures 1-5, 2-1, 2-2A, 2-2B, and 11-8 either one or two ponds is indicated. Can Jones & Stokes provide some clarity concerning the number of retention/infiltration pond(s) that will be constructed? None of these figures show a cross section of the pond(s). Please provide such a cross section drawing.

Ortman, David

Comment O-1.214

Groundwater Quality/Mitigation: It states that additional sedimentation ponds would be constructed. These sedimentation ponds are not shown on Figures 1-5, 2-1, 2-2A, 2-2B. Where are these sedimentation ponds located? Please provide a cross section drawing of these ponds.

Ortman, David

Comment O-1.201 4.4.1 pp.4-16/4-17 This section on mitigation measures raises more questions than it answers. It states that a retention/infiltration pond would be constructed at the bottom of the mine site. At what stage, or in what year, would this pond be constructed?
Ortman, David

Comment O-1.202 If a single retention/infiltration pond would be constructed, why does Figure 2-2A appear to show two retention/infiltration ponds?
Ortman, David

Comment O-1.204 It states that additional sedimentation ponds would be constructed. These sedimentation ponds can not be located on any of the plans. Please identify and locate where these ponds would be constructed.
Ortman, David

Response As discussed above, the proposed single infiltration pond would need to be replaced with a multiple-point recharge system (FEIS, Section 4.4.3.2). The final number of and location of ponds on the site would be determined during final design.

The ponds shown on Figure 2-2A consist of a water treatment pond and an infiltration pond in accordance with King County requirements. These schematic diagrams are not meant as design documents. Rather, they are included to give a general idea of the size of facility required. The design and precise location of these ponds on the site would be determined during final project design.

Comment O-1.198 What water quality testing is proposed for the retention/infiltration pond?
Ortman, David

Response Water quality testing would be performed in accordance with the arsenic remedial action plans and the operating permits for the mine. In addition, King County could require additional water quality monitoring.

Comment O-1.193 Please explain how the retention/infiltration pond would capture all the surface water from the mining operation as stated in this section. It would appear from the discussion in Chapter 4 that most of the surface water would infiltrate directly into the groundwater. Is this correct? What percentage of the surface water from the mining operation would be captured by the

retention/infiltration pond?
Ortman, David

Comment O-1.283 Turbidity/Proposed Action: It states that surface water from the mining operation would infiltrate to the underlying aquifer via the proposed retention/infiltration pond. This statement is unclear. As material is uncovered, surface water would drop straight down. Please clarify how the interceptor ditch system is suppose to work.
Ortman, David

Comment O-1.205 How will runoff paths direct runoff into the retention/infiltration pond if the material remaining is porous?
Ortman, David

Response Because the surface materials at the site consist mainly of highly permeable sands and gravels, most rainfall falling on the site infiltrates immediately. Surface runoff is generated only from impermeable surfaces, such as roads and compacted soils. The exact percentage is not relevant to the analysis, but it is a very small percentage of total precipitation at the site. As proposed, the infiltration pond in the floor of the mine could overflow during storm events exceeding the 25-year storm. Mitigation measures described in Section 4.4 would replace the single pond with a multiple-point infiltration system. The intent of mitigation would be to infiltrate 100 percent of the surface runoff generated from the mine into the aquifer, based on a 100-year storm.

Comment C-2.003 Allowances for retention/infiltration pond size—King County 25-year, 24-hour storm standard, do not appear to have been validated for the microclimate of the Maury Island site. The applicant should propose a plan as part of the DEIS to implement a rainfall monitoring program, which would provide the basis for verifying the proposed standard or establishing a standard appropriate for the site and surface hazard runoff characteristics.
Ernst, William

Response All stormwater facilities would be constructed in accordance with county and state requirements. During the design process, King County would determine if there is a need for a site-specific rain gauge or other western monitoring station. However, design would require long-term weather data, which can be obtained only from a station with a long record of observations.

Comment C-8.043

Provide a design of the retention/infiltration pond, and specify what occurs if capacity is exceeded, and impacts to the shoreline and nearshore, and specify how frequently such storm events have occurred in the past 25 years. Mention is made that smaller units than the retention/infiltration pond could be established—provide the design for these smaller units.

Vashon-Maury Island Community Council

Response

Design details are neither appropriate nor required for an EIS (WAC 197-11-055). By definition, the 25-year storm occurs, on average, once every 25 years. However, the final mine design would be required to manage and infiltrate runoff from storms up to the 100-year rainfall, as required by King County Surface Water Design Manual, and as described in Section 4.4.3.2.

Comment

S9.5. Why is a new stormwater pond included in the Proposed Action, but not in the No-Action Alternative?

Kuperberg, J. Michael, Ph.D.

Response

No stormwater pond is required under the existing grading permit, and therefore King County assumes none would be installed.

Springs

Comment C-8.035

Rainwater reaching the site would more likely flow overland to the Sound and not enter the aquifer at all with removal of material at the site. Quantify the discharge rate of the springs located near the beach, and compare that to rates anticipated during and after mining, and how this will impact the islands' aquifer.

Vashon-Maury Island Community Council

Response

Following mining, virtually all precipitation at the site would continue to infiltrate. Only in locations where impermeable surfaces are introduced, such as roads and the containment berm, would overland flow occur. The proposed single infiltration pond could create overland flow during storms exceeding the 25-year storm. Geo/Hydro Mitigation 1 (Section 4.4.3.2) describes a revised infiltration scheme that would infiltrate all precipitation that falls on the site, based on the 100-year storm.

Recharge to the aquifer and discharge from the springs to the Sound would likely increase as a result of mining due to increased infiltration.

Comment C-8.031

Some observers think there is more than one spring on the site about the beach, representing surface water. Provide an assessment of this surface water and onsite ecology, along with discussion/conclusions regarding impacts of the proposed action and alternatives.

Vashon-Maury Island Community Council

Response

In response to this and additional comments, additional information has been added to Section 4.2.3 describing surface water at the site, and a new section has been added to the FEIS to address impacts on surface water (see FEIS Section 4.3.6). No seepage zones above the beach level have been identified by the EIS Team. AESI reported that a seep was present east of OBW-9, the lowest monitoring well drilled on the site. This apparent seep is at an elevation of approximately 30 feet. No other factual testimony of seepage zones above the beach level has been presented. Surface water does not play a significant role in the ecology of the site.

4.4 Adverse Impacts and Mitigation

4.4.1 Significance Criteria

Comments and responses related to significance criteria are included in the sections addressing the primary issues.

4.4.2 Measures Already Proposed by the Applicant or Required by Regulation

Comment G-3.012

12. Section 4 4 1. This discussion contains no analysis of, nor proposals for monitoring impacts to water quality in Puget Sound via seepage to the beach. This is of special concern considering that Figure 2-2A, Final Site Contours, shows the proposed retention/infiltration ponds immediately adjacent the portion of marine shoreline that will be removed to accommodate barge loading. Considering that the site is contaminated by arsenic and lead—with arsenic contamination beyond a level that requires industrial cleanup—an analysis as well as prevention and monitoring plans should be required.

People for Puget Sound

Response

Seepage along the beach would ultimately originate as groundwater. Assessment of impacts to groundwater quality is provided in Section 4.3.2 of the DEIS. Potential impacts of arsenic and other metals on groundwater quality are discussed in Section 10.3.4. This analysis has been augmented with additional information provided by Ecology, who found no evidence of arsenic in groundwater at the site.

The proposed single infiltration pond could lead to surface water flows into Puget Sound. The mitigation measures in Section 4.4.3 would prevent surface water overflows into Puget Sound.

Comment C-7.013

Why aren't there mitigation clauses that would force the mining corporation to provide water in perpetuity to Vashon and Maury Island residents should the mining contaminate the sole source aquifer?

Brown, A.

Response

The purpose of this document is to determine if significant threats to the water supply are possible. It is unlikely that the proposed project would contaminate any offsite groundwater source if the mitigation measures discussed in the FEIS are incorporated into site development plans. Issues related to arsenic and other metals in surface soils at the site are discussed in Chapter 10.

4.4.3 Remaining Adverse Impacts and Additional Measures

Comment O-1.210

p. 2-13 It states that the 5-foot-wide benches would be back-sloped slightly into the hillside and laterally sloped to encourage gravity flow. Please explain why it is necessary to provide lateral slopes for gravity flow if there is little to no runoff from the site.

Ortman, David

Response

Some surface overland flow occurs adjacent to impervious surfaces and areas of compacted soils. Additional surface runoff could also occur during reclamation, although the amount would be small and all would be infiltrated onsite. The amount of runoff would decrease and should become negligible after full restoration. Nonetheless, infiltration facilities would be staged throughout the site to prevent the need for concentrated infiltration facilities.

Comment I-9.008

… EIS fails to fully evaluate and address … the "guarantee" of a 15-foot separation between mining and aquifer … there is no adequate assurance that the proposed separation will be maintained throughout the mining operations.

Mackey, Cyndy

Response

The Applicant would monitor groundwater levels throughout the life of the mine based on a Groundwater Monitoring Plan required as part of the permit. Final mine design and grades would be adjusted, as needed, to maintain a minimum 15-foot separation between the mined surface and the top of the groundwater table. Geo/Hydro Mitigation 2 would provide for additional monitoring of groundwater levels throughout the life of the mine.

Comment O-1.183

4.3.1.1 p. 4-11. This section states that with the appropriate drainage and recharge designs mining would not reduce the amount of water contributed by the site to the aquifer. Why are recharge designs needed when it states in Table S-3 that the site is not a recharge area?

Ortman, David

Comment O-1.211

Aquifer recharge/Mitigation: It states "To minimize changes in the rate and path of recharge waters on the site …". How can the proposed project impact recharge rates if it is located within a groundwater discharge area rather than a recharge area?

Ortman, David

Comment C-8.034

Additional measures … Are these measures that will be taken, or simply available for discussion? Why would the applicant need to reduce recharge impacts if this is a discharge area?

Vashon-Maury Island Community Council

Response

Sections 4.2.4.6, 4.3.1, and 4.4 of the FEIS have been modified to clarify the groundwater recharge regime at the site, and to clarify mitigation measures. More details are given above in comments and responses Section 4.3.1.

Comment I-7.036

Will one of the mitigation measures be deed restrictions on the property designating it as a aquifer recharge protection area that cannot be developed after mining.

Meyer, Michael

Response

The future redevelopment of the site would depend upon the zoning and comprehensive plan in effect at the time.

Comment O-1.207

Why is groundwater level monitoring limited to four times a year? Shouldn't groundwater level be monitored on a weekly basis?

Ortman, David

Response

Selected monitoring wells would be required to have continuous recording instruments to allow for groundwater elevations to be recorded daily. The final monitoring plan would be developed as part of the mine plans.

Comment

Please include specifications and diagrams for temporary water collection ponds; include the water conservation plan, and describe sources of water and whether this represents diversion of water from other island uses. Provide a copy of the 25-year, 24-hour storm event retention/infiltration pond design and discuss impacts of the overflow and silting in more major rain events. Include a copy of the design of the rock check dams, and action plans for ground water seepage.

Vashon-Maury Island Community Council

Response

The final design of the facility and detailed plans are beyond the scope of the FEIS. Final design would be in accordance with county and state regulations and mitigation measures deemed necessary by King County. Additional information has been added to Section 4.3.1.1 to clarify potential sources of water used for the project and the impact of that use. Impacts of potential overflow of the retention/infiltration pond are discussed in Section 4.3.6 and mitigation measures are discussed in Sections 4.4.3.2 and 4.4.3.4.

Comment O-1.215

Breach an aquifer/Mitigation: It states that groundwater level monitoring would cease during the reclamation phase. Why isn't monitoring required for the life of the project?

Ortman, David

Response

No breach of the aquifer would be expected during mine reclamation. Any breach that would occur would occur during active mining operations.

Comment I-1.024

… if the water table is breached, the mitigating action is "immediate notification of King County and technical experts," but what would happen next is not specified

Shipley, Frank

Response

Appropriate action would be needed. However, as discussed earlier, the aquifer is well defined at this time and additional information would be developed prior to the mining operation. Thus, based on existing information, the potential for aquifer breach has been minimized.

Comment O-1.208

4.4 pp. 4-17/4-18 How does Taiheijo Cement Corp. handle drainage plans on its other mining sites?

Ortman, David

Response

Drainage designs and regulatory requirements in other jurisdictions are not relevant to analysis of impacts at this site.

4.5 Cumulative Impacts

Comment I-9.012

… cumulative impacts are dismissed without any analysis

Mackey, Cyndy

Response

No cumulative impacts are anticipated related to geology and hydrogeology. However, in response to public comments, Chapter 13 has been added to the FEIS to address cumulative effects.

4.6 Significant Unavoidable Adverse Impacts

Comment 1.235

Aquifer recharge/Significant unavoidable adverse impacts: Again, this summary claims that the proposed project would "likely result in greater peaks and lows [sic] in recharge rates over the course of a year." How can the proposed project impact recharge rates if it is located within a groundwater discharge area rather than a recharge area?

Ortman, David

Response

Sections 4.2.4 and 4.3.4.1 of the FEIS have been revised to clarify the existing groundwater regime and the likely impacts of the proposed mine. As discussed earlier, the groundwater beneath the site is an important element of the island groundwater resource. Preservation of the existing resource is essential in the design and operation of the mine, and thus mitigation measures have been identified to reduce or eliminate potential impacts.

4.7 Citations

4.7.1 Printed References

Booth, D.B. 1991. Geologic Map of Vashon and Maury Island, King County, Washington with text to accompany map MF2161 U. S. Department of the Interior, U.S. Geologic Survey, Map Distribution Center, Denver, Colorado.

Carr, J.R. Associates 1983. Vashon/Maury Island Water Resources Study, Seattle, Washington, December 1, 1983.

Driscoll, Fletcher G. 1986. Groundwater and Wells. Johnson Filtration Systems.

Pacific Groundwater Group. 2000. Maury Island gravel mine hydrogeologic impact assessment. May. (Ecology Publication Number 00-10-026.) Seattle, WA. Prepared for Washington State Department of Ecology, Northwest Regional Office, Bellevue, WA.

4.7.2 Citations in Comments

See comment letters in Volumes 5 and 6 for references cited in comments.

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